1954

Management engineering report on the Rensselaer Valve Company.

Ryavec, E. A.

Rensselaer Polytechnic Institute

MANAGEMENT ENGINEERING
REPORT ON THE
RENSSELAER VALVE COMPANY

E. A. Ryavec
and others

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MANAGEMENT ENGINEERING REPORT ON

THE RENSSELAER VALVE COMPANY

E. A. RYAVEC

[and others]

MANAGEMENT ENGINEERING REPORT

on the

RENSSELAER VALVE COMPANY

of

Cohoes, New York

Vol. 1.

By

Naval Officers in the Management Engineering Department

[Vol. 1 – Text
Vol 2 – Appendices]

Submitted to the Faculty of Rensselaer Polytechnic Institute in partial fulfillment of the requirements for the Master of Science Degree.

Rensselaer Polytechnic Institute
Troy, New York
June 1954

FOREWORD

This report is the result of a management engineering survey of the Rensselaer Valve Company of Cohoes, New York by a group of Naval officers attending a course in Management and Industrial Engineering at Rensselaer Polytechnic Institute in Troy, New York.

The group of officers and the faculty of the Management Engineering Department of Rensselaer Polytechnic Institute wish to express their appreciation to the Company for allowing them to use the plant and offices of the Company as a "laboratory" in which to conduct this survey. We wish to thank particularly the many employees of the Company who gave so unstintedly of their time and effort in order to assist the group in making the survey.

None of the statements in the following chapters should be considered as critical of any of the individuals connected with the Company. The survey attempts to compare the methods of the Company with those considered desirable by authorities in the field of Management. Any suggestions offered are hoped to be in the nature of constructive criticism.

This survey was limited principally to those phases of the Company's operations suggested by the Vice President of Manufacturing of the Company. Because of the limited time and manpower available it is believed that even these limited fields were not investigated as thoroughly as might be desired. However, the report suggests additional study which might be carried on by the Company.

The student officers wish to express their appreciation to

Professors W. F. Spafford, E. H. Van Winkle and H. W. Martin for their advice and assistance.

Throughout this report the numbers in parentheses refer to correspondingly numbered appendices, bound separately.

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CHAPTER I

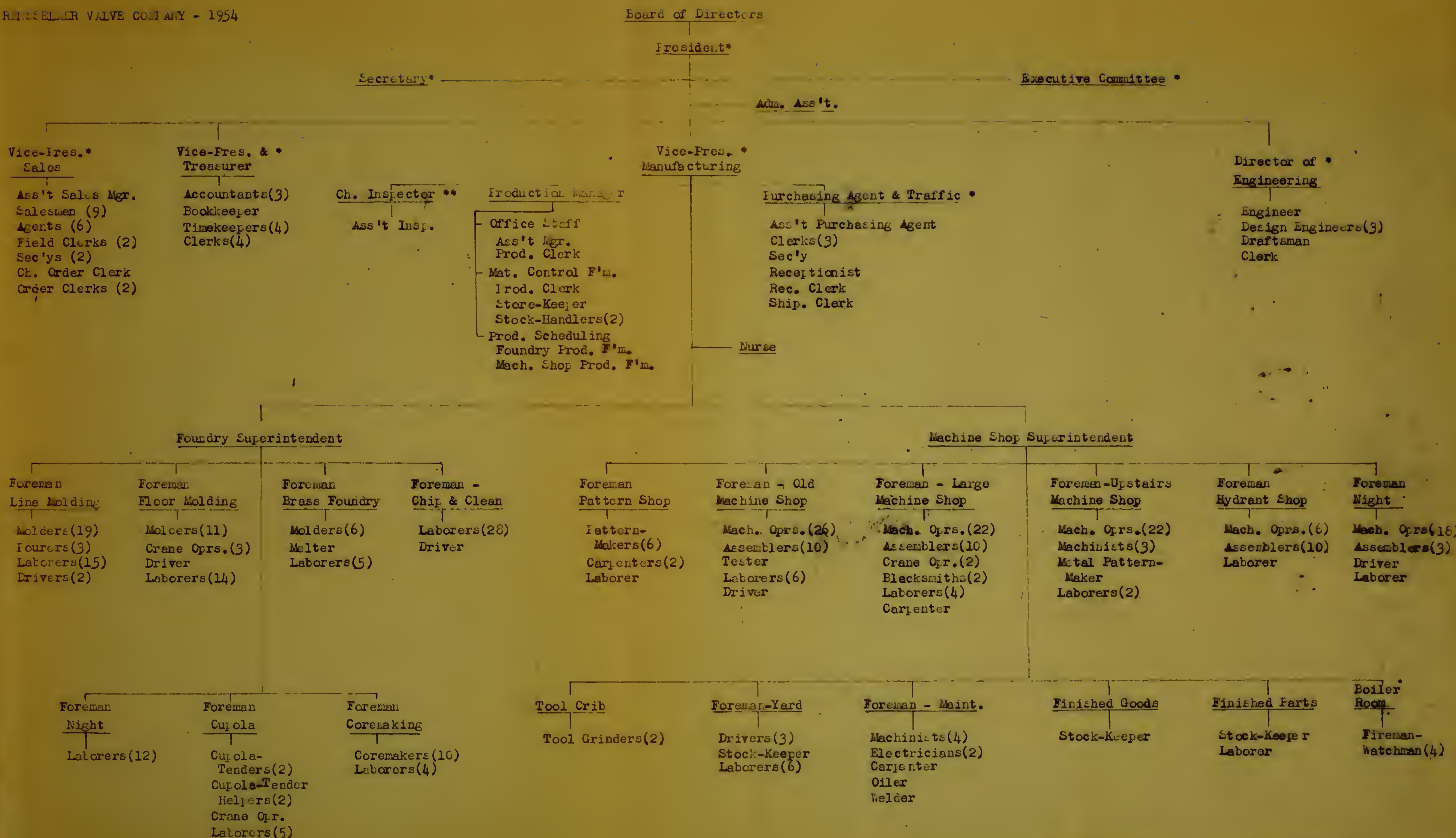
ORGANIZATION

1. FINDINGS

The organizational structure of this company is stable and yet sufficiently flexible and adequate to meet normal work schedules and even suddenly increased work schedules when required. There appears to be no organizational components or positions which should be deleted. All key management persons understand, in general terms, the purpose and work of each person they contact in organization. This thought applies also, generally, to all the employees. As often as not in a relatively close-knit and established company of this type and size, detailed explanations of key-position functions, responsibilities and authority and relationships exist only in the minds of members of management. This is so in the case of the Rensselaer Valve Company. Furthermore, all present position detailed functions, responsibilities and authority and relationships existing in the minds of the Company employees are the result of usage and are not in formal writing. There are no up-to-date job descriptions in existence. A matter of commendable record is the fact that the number of personnel employed, about 375 employees, has been relatively constant for the past four years. Also, there have been no worker layoffs during this period. This indicates for present state of business a healthy organization both in manufacturing know-how and in high sales ability to market the output of valves and hydrants on a nationwide distribution basis.

A close approximation of the existing Company organization is reflected in Chart 1-1. It is possible that certain positions indicated

RENSSELAER VALVE COMPANY - 1954



** When necessary, reports on inspection to President

CHART 1-1

to be staff are really line positions, such as that of Purchasing Agent. Also, certain positions indicated to be line are really staff positions, such as that of Vice President and Treasurer and that of the Director of Engineering. By way of a few words of explanation, a line position here refers to a supervisory position of direct management control of and accountability for primary Company work, that is, to make valves and to sell them. A staff position refers to a position of service to primary Company work. Certain position incumbents have more than one organizational name, such as the Vice President and Treasurer who is known also as the Controller.

A summary of subsequent chapters' detailed Appraisals and Recommendations which pertain to organization is given in the next few pages.

2. APPRAISAL

In general it can be stated that the Company organization fulfills the prime reason for its existence, that is, to make valves and hydrants for sale at a profit for the owners of the Rensselaer Valve Company.

The volume of business in terms of gross sales has increased from a total of 3.2 million dollars in 1952 to a total of 3.7 million dollars in 1953. Gross sales in 1954 are expected to exceed 4 million dollars. This volume of sales in 1954 is expected by top management with practically no increase in organization.

The ratio of production to non-production workers is about 4.2 to 1. This ratio is considered satisfactory for an industrial enterprise of this size and type at the present stage of plant facilities and equipment mechanization. The recommended increase of 2 non-production workers, made in subsequent chapters, would decrease this ratio to 4.1. This ratio change is insignificant considering the additional savings possible from scrap reduction and the better employee-employer relations which should result from the recommended personnel increase.

Some means for recording the size and dimensions of managerial positions usually is considered necessary. Organization planning requires that the organizational structure and the allocation of functions to specific positions be clearcut, not only to achieve better the objectives of the enterprise but to have a reference point from which to proceed in marking out other coordinate and subordinate positions and their functions.

It is for this reason that key position descriptions are necessary to augment a general organizational plan or chart by recording for reference and use the functions or objectives of each managerial position, the breakdown of each function into its component parts or duties, and the important relationships involved in accomplishing each function. Once the managerial requirements of the Company are reduced to writing, the components of the organizational structure can be planned and then combined to provide an organizational chart of real worth. Therefore, position descriptions and an organizational chart appear to be necessary.

Chapters IX and X indicate areas where cost savings can be effected and where additional profits can be earned within the time of one year of effecting recommendations. They are summarized as follow:

i) Lowered Employee Compensation Insurance rates should result by instituting a constructive safety program. The attendant savings would be sufficient to defray a substantial portion, if not all, of the yearly salary of the Director of Industrial Relations.

ii) Lowered scrap rates should result by initiating a quality control program. The attendant savings would be sufficient to defray a substantial portion, if not all, of the yearly salary of the engineer in charge. A Quality Control Engineer or a Production Engineer should be in charge of the quality control program as well as of the industrial engineering program which deals with new and improved manufacturing methods, equipment and facilities.

3. RECOMMENDATIONS

i) An organizational chart of the Company should be prepared and copies should be distributed to all key management personnel and should be posted on bulletin boards maintained for all employees. Such organizational charts should be revised when necessary.

ii) The position of Director of Industrial Relations should be established. The incumbent of this position should report to the President, as recommended in Chapter X.

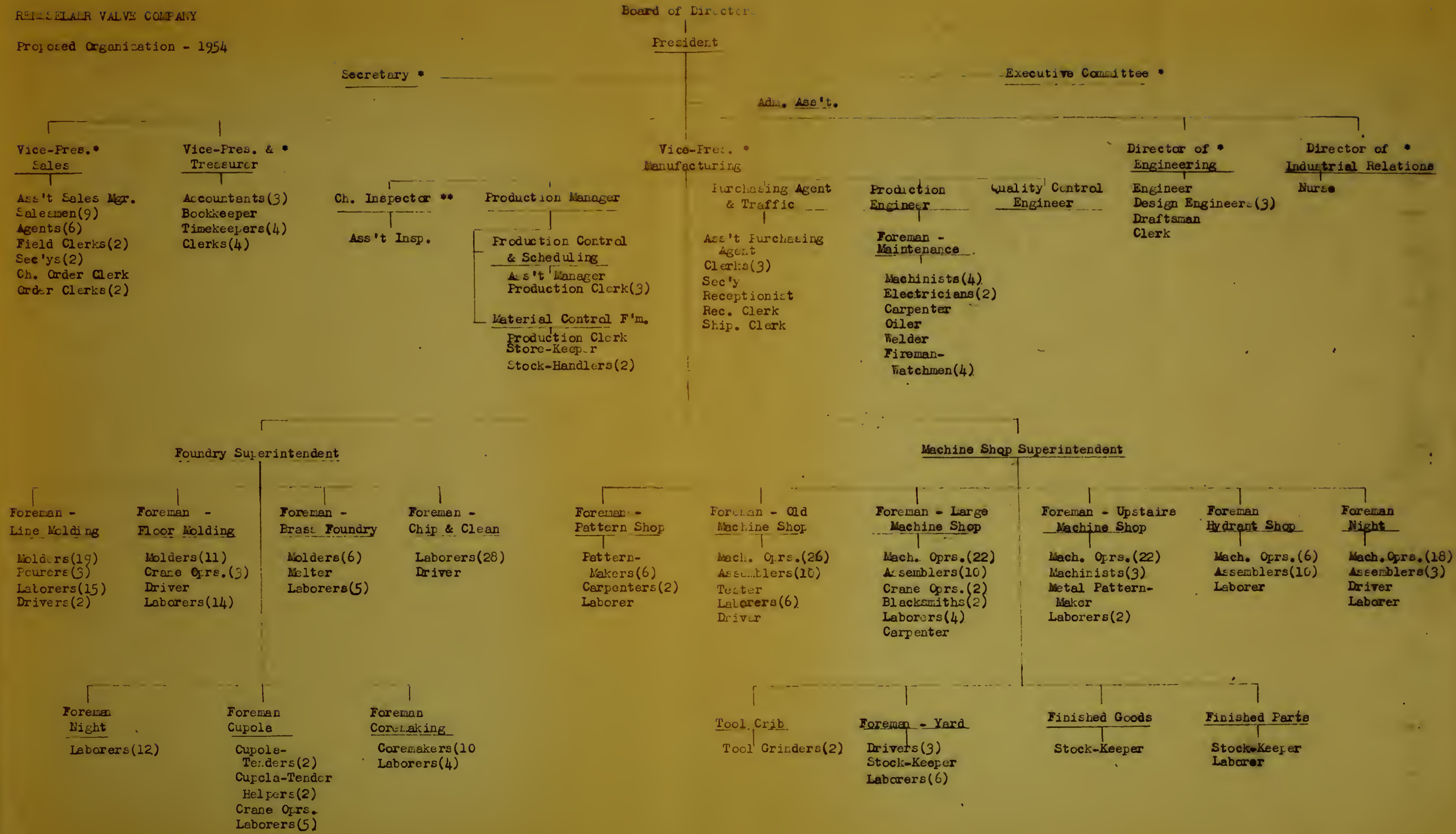
iii) The positions of Quality Control Engineer and Production Engineer should be established. The incumbent or incumbents of these positions should report to the Vice President of Manufacturing, as recommended in Chapters V and IX. As a start only one person should be assigned to both these positions.

iv) Once the position of Production Engineer is established and filled, the Maintenance Shop, including the Fireman-Watchman, should be placed under the supervision of the Production Engineer.

The revised recommended organization is submitted as Chart 1-2.

RENSSELAER VALVE COMPANY

Proposed Organization - 1954



** When necessary, reports on inspection to President

CHART 1-2

CHAPTER II

SALES

1. FINDINGS

1.1 SCOPE

The organization of the Sales Department of Rensselaer Valve Company is shown on Figure II-1. It has been built to cover the sales and distribution of valves, hydrants and other accessories in the very specialized and highly competitive water distribution field. This segment of the water works industry deals with municipalities in the transportation, filtration, distribution and, finally, the disposal of water used both in industry and the home. While the number of customers is numerous and greatly dispersed, they are well known to this and all other competing companies. The type of product is standardized and there exists very little difference between products of competing companies. Such a situation as this requires a highly trained and specialized sales force offering engineering service, prompt customer attention and a high degree of personalized calling in order to obtain continued business from long-established customers.

Since the Company manufactures cast-iron valves, little effort has been devoted to the industrial valve field. Not only would the entrance into the industrial field require steel and bronze body valves, but also the sales force would have to be reorganized.

Of the fifteen companies reporting to the Valve Manufacturers' Association in 1953, Rensselaer Valve did approximately 10.4 percent of the water works valve business. Approximately 6.9 percent of the hydrant business reported was captured. Without new products or an

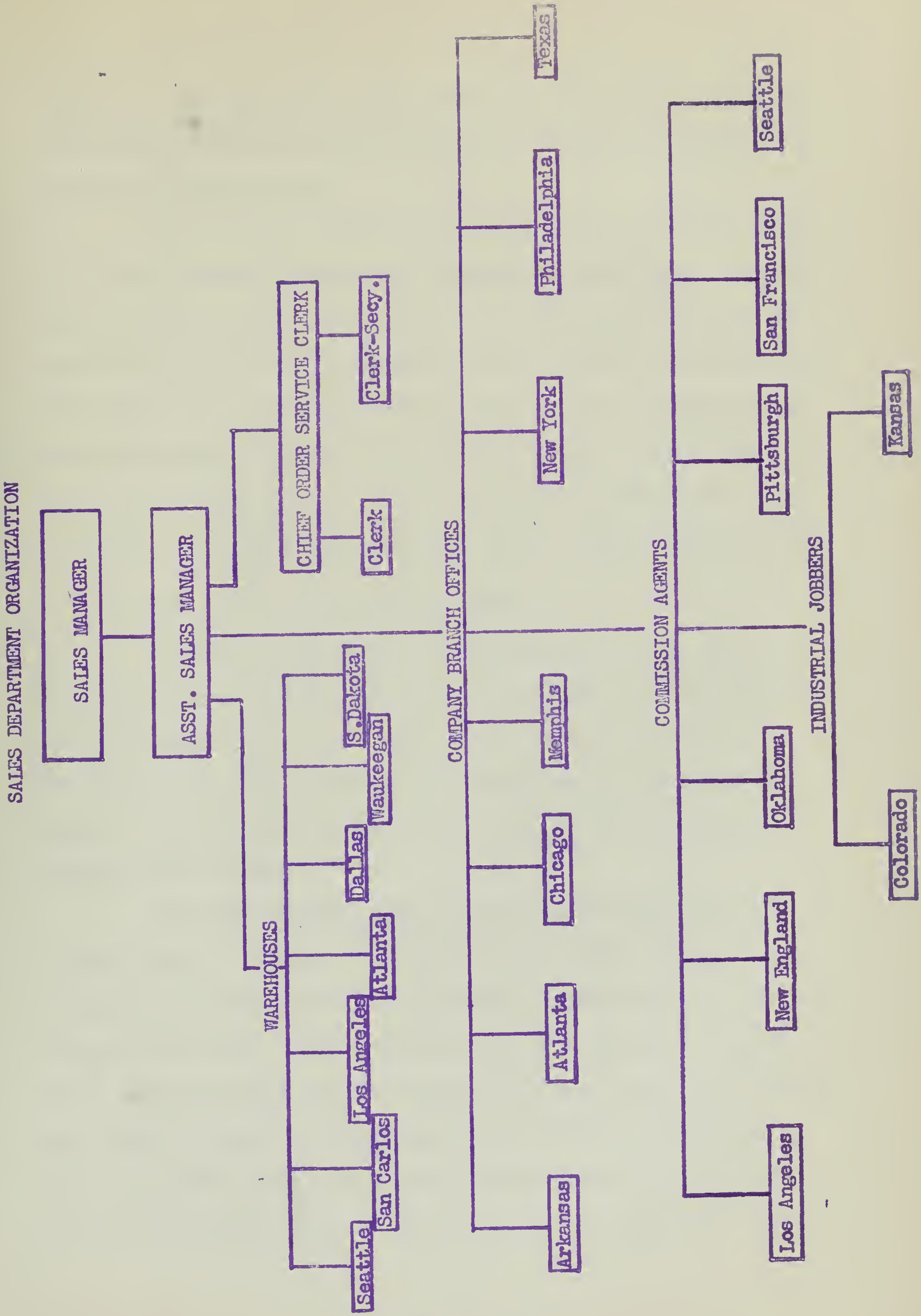

SALES DEPARTMENT ORGANIZATION
SALES MANAGER
ASST. SALES MANAGER
CHIEF ORDER SERVICE CLERK
Clerk
Clerk-Secy.
WAREHOUSES
Seattle
San Carlos
Los Angeles
Atlanta
Dallas
Waukeegan
S.Dakota
COMPANY BRANCH OFFICES
Arkansas
Atlanta
Chicago
Memphis
New York
Philadelphia
Texas
COMMISSION AGENTS
Los Angeles
New England
Oklahoma
Pittsburgh
San Francisco
Seattle
INDUSTRIAL JOBBERS
Colorado
Kansas

Figure II-1

increase in municipal water works construction the continued expansion of the sales market can be gained only by the increase in these percentages of market figures.

Rensselaer has increased its West Coast sales steadily until in 1953 this business amounted to 39 percent of gross sales. This compares with 26 percent for the East, 17 percent for the Midwest and 18 percent for the South and Southwest. During the year each of the other areas, while showing an increase in the dollar value of product sold, fell approximately two percent in gross percentage of company sales. The trend for the past years seems to indicate that the Pacific Coast is headed for an even larger percentage of this company's gross sales.

1.2 OPERATION OF THE SALES DEPARTMENT

As shown on Figure II-1, the department is under the supervision of the Sales Manager who is a vice president of the corporation. The Sales Manager spends approximately sixty percent of his time traveling in the field to assist the branches and to support the sales policy. The day-to-day operation of the department falls upon the Assistant Sales Manager.

No formal sales budgets are maintained for the branches or for the Company as a whole. The yearly sales forecast is estimated on the previous year's business tempered by experience and the general business conditions. This forecast is used as a goal by all departments and is expressed in dollar volume of sales. Sales goals for the past number of years have been higher always than the previous year. This is expressed as an increase such as five percent or ten percent over the last year's sales. In 1953 the volume of sales increased

19 percent over the year 1952; the goal set had been about 10 percent. This year, 1954, a four million dollar year is the forecast and the goal. To reach this, sales will have to increase approximately 7 percent.

The Company also uses the percentage of market figures published by the Valve Manufacturers' Association to check their position in the water works valve industry both monthly and annually. By comparison of totals for a given period in the previous year's sales and the percentages of market figures, a good overall control is maintained.

The sales picture is analyzed from the Orders Received and Unfilled Report (2.1) and the Monthly Summary of Orders Booked by States and Sales Territories (2.2). This analysis is made by the Sales Manager-Vice President of Manufacturing and the President.

Sales prices of products in this industry include freight to destination charges. The Company therefore includes freight as a cost of distribution. This is accomplished by dividing the country into zones and having a price list for each zone; thus, although freight amounts to approximately six percent of gross sales, it is absorbed by the customer. This does have the effect of unfavorable prices to customers where another manufacturer is located close by. The Company has had to lower prices in areas where competition has been keen.

1.3 FIELD BRANCHES

The field force consists of 15 branches staffed with 21 salesmen. Seven of the branches are direct company offices; six are commission agents; and two are industrial jobbers. The commission

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

agents, though independent business men, devote a substantial part of their time to the Rensselaer account.

The basic compensation for commission agents averages 7 per cent of their gross sales volume; for the jobber type distributor , approximately 8 percent of gross sales volume with the jobber doing his own billing and collecting. The Company salesmen are on straight salary at present with all expenses paid by the Company. The Company furnishes sales literature, catalogs and most of the advertising.

1.4 WAREHOUSES

The Company maintains stocks of standard 4" to 12" valves at seven points in the country. While these are shown as warehouses on the organization chart, the stock in them is termed consigned stock. They are operated in conjunction with company offices or commission agents and usually are the commercial type warehouse with a space charge and a handling fee for all in and out transactions. All costs are paid by the Company. No company personnel are assigned to these warehouses.

Each stock point furnishes to the home office a Monthly Inventory Sheet (2.3) which is checked against the Master Kardex Inventory (2.4). No set high or low inventory limits are shown on the master consigned stock card. The cards are reviewed monthly by the Sales Manager and the Assistant Sales Manager. At this review the proper levels are determined and orders for manufacture of consigned stock are initiated.

The use of warehouses and consigned stock accomplishes two objectives. First, to have equipment available for immediate shipments.

In a buyers' market this is of prime importance as these standard valves are items which the customers use daily and do not as a rule plan months in advance to purchase. Second, to obtain the lowest possible shipping rates, shipments of large valves and hydrants are combined with shipments of standard 4" to 12" valves to the consigned stock points. This results in a considerable saving in freight charges.

1.5 ORDER SERVICE

The work of Sales and Order Service at Troy breaks down into two distinct parts. One, obtaining the necessary prices and delivery information to prepare a quotation on jobs which require a bid from the home office. Most all valves over 12" and multiple hydrant orders require such a quotation. Two, processing the necessary paperwork after an order has been received from a customer.

1.6 QUOTATIONS

The branch office, after obtaining a request for a quotation for non-stock valves or hydrants, forwards all necessary specifications and delivery requirements to the home office. The request is reviewed by the Assistant Sales Manager to determine whether Rensselaer can manufacture equipment which meets the specifications or can offer alternate equipment taking such exceptions as necessary. If it is determined to bid the job, the Assistant Sales Manager acts as the collection point for information. The Engineering Department furnishes the size and type of special equipment such as hydraulic cylinders, along with prices and the estimated delivery of same. This information is obtained from the Purchasing Department if necessary. Engineering

also reviews any pattern changes required and after consultation with the Pattern Shop estimates the cost of such changes. The Accounting Department furnishes the latest cost of production figures on standard valves. The Production Manager is consulted on the best possible delivery schedule. When all cost figures and delivery dates are assembled, a price is quoted.

The quoted price is made up of cost figures plus distribution costs plus a profit. Data are available to arrive at the manufacturing and distribution costs. The amount of profit to be added to the particular bid depends on many variables such as type of product, number of units involved, shop productive capacity at the particular time, past experience with the customer, type of competition and the desirability of having Rensselaer products in the community for future expansion and replacement. If the job is large, the final price is arrived at after consultation among the Sales Manager, Vice President of Manufacturing and the President. On smaller bids the Assistant Sales Manager adds a standard profit percentage to the costs and bids the job. The bid is then filed; and if an order develops from the quotation, these figures are used.

1.7 PROCESSING THE SALES ORDER

In most cases the Ditto Master of the sales order is received from the branch sales office. If it is not, the Assistant Sales Manager initiates it. This Ditto Master (2.5) becomes, when completed, (i) permanent record of order, (ii) customer's acknowledgment, (iii) shop order to work, (iv) authority to ship, (v) invoice, and (vi) account receivable.

Figure II-2 depicts the routing of this paper through the various departments of the Company. All orders are treated the same until Order Service has completed its work of assigning an order number and checking price extension. At this point the order is classified according to type. There are three types as follows:

i) Orders for material shipped from consigned stock. This order, as shown, does not reach Production Control since no manufacturing is done on this type of order. The material purchased has been shipped from a warehouse and this order is used by Sales and Accounting to bill the customer and maintain records of consigned stock. The order for replacement of material shipped from consigned stock is treated similar to (ii) below.

ii) Orders for standard material. This is an order for material on which no additional engineering is required for the plant to complete. As seen on Figure II-2, this order is routed to Production Control for scheduling and no copy is sent to Engineering. Most 4" to 12" valves and hydrants fall into this classification, which amounts to about 75 percent of the Company's production.

iii) Orders requiring further engineering and design clarification before the product can be produced. This order Ditto Master is run by Order Service with a copy being sent to Engineering along with the original customer's order. At the same time the Ditto Master is sent to Production Control for scheduling. Since this order usually is for large valves, the foundry production schedule can be made before the exact specifications are completed by Engineering. This is possible because most changes do not involve the body casting.

PROCEDURE FOR SALES ORDER.

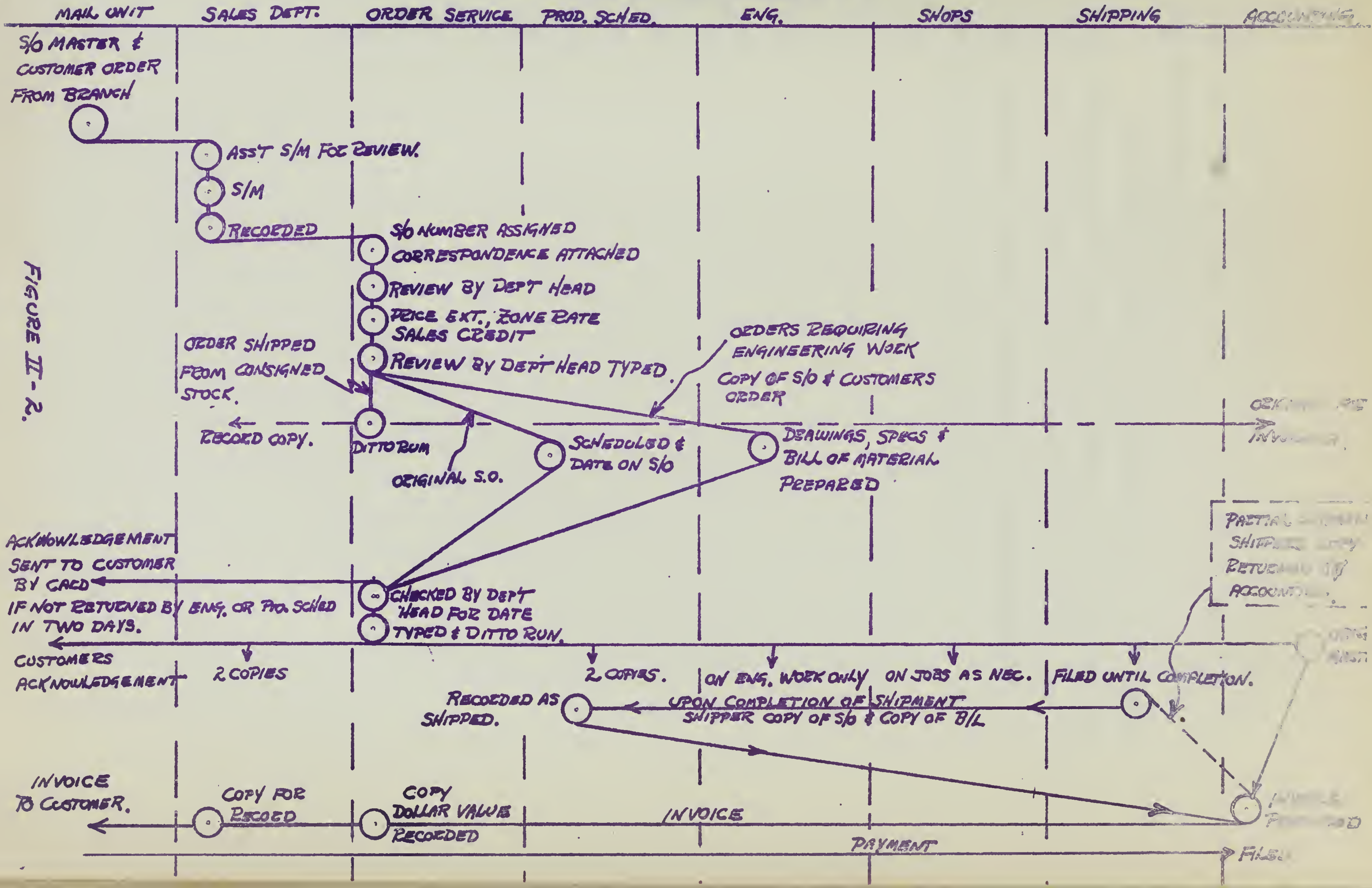


FIGURE II - 2.

As the order Ditto Master progresses through the plant, copies made from this Ditto Master with additional information added become other reports (2.6 and 2.7).

Order Service compiles two important reports for management while processing the sales order Ditto Master. One is the Daily Order Report which summarizes the dollar value of orders received. The other, the Orders Received and Unfilled Report, is compiled weekly from figures recorded from the sales order Ditto Master.

2. APPRAISAL

The sales force at present seems to balance the productive capacity of the physical plant. Deliveries of valves above 12" are running approximately twelve weeks, with the very large valves running as high as twenty weeks. The supply of 4" to 12" valves in warehouse stock is not sufficient to take care of present shipments, so that an order for a number of these sizes takes approximately four to six weeks. There is in all probability a number of orders lost which could be obtained if present deliveries were improved.

With the advent of a strong buyers' market predicted by economists and businessmen the need for prompt deliveries will become more pronounced. Competition will offer prompt deliveries and the customer will come to demand prompt deliveries. Thus, unless there is an improvement in delivery dates, there appears to be no urgent need for an increased sales effort.

The hydrant sales picture presents another problem. The sales of Cory hydrants has been falling for the past few years. The indications from analyzing the lost business are that this piece of equipment is too high-priced for its intended use. Competition with a simplified, less expensive hydrant is taking the majority of the business. The sales force seems unable to overcome this price differential. The new Rensselaer hydrant should be the solution to this problem. This competitively designed hydrant should increase sales to the desired volume and, coupled with the Cory hydrant, should offer a complete line to the customer.

The branch offices are located to give adequate coverage.

They appear to be located in the areas where potential sales are the greatest.

Although the cost of maintaining direct sales offices exceeds the cost of commission agents by approximately two percent of gross sales, the Company offices appear to be the backbone of the sales organization. All the present commission agents obtained their training and experience as salesmen from the Company in branch offices. The excellent men who prove good salesmen with an understanding of Rensselaer Valve policies are given the opportunity of entering their own businesses as commission agents. The Company in this manner maintains a close control of its commission agents and also offers almost unlimited opportunities to able men. The number of six commission agents and seven branch offices seems to be an equitable balance to continue this practice.

The two jobbers covering the sparsely settled States of Colorado and Kansas are maintaining a satisfactory volume of business. Their costs are not appreciably higher than would be encountered with a commission agent or branch office.

Upon examination of the sales volume for the different offices it appears that some of them could be strengthened by additional personnel. With the exception of Los Angeles and Pittsburgh the average sales volume per salesman is approximately $170,000 per year. Los Angeles with a sales volume of $820,000 and only two salesmen has an average of $410,000 per man. Since the salesman has an upper limit where the amount of work necessary to maintain a given volume of

business precludes obtaining new orders or giving proper service to present customers, it would appear that two or three additional men could be used in this territory. In all probability the increase in sales coverage would more than offset the increase in cost. Pittsburgh with only one salesman and a volume of $350,000 last year would seem to fall into the same category. (See Recommendation 3.1)

The reverse may be true in the Texas territory. Last year one man was able to secure only $99,000 of sales. It would appear that this territory covers so much land area that one salesman cannot adequately cover it. The one man is spreading himself so thin that he does not have sufficient time to cultivate the friendships so necessary in this type of selling. Texas needs to be surveyed as to the cause of this low volume, and steps should be taken to increase sales.

The present method of handling the quoting of jobs seems to be rather involved. It is felt that all figuring of sizes and pricing of products should be handled in the Sales Department. Preferably the figuring of jobs should be done in the branch field offices where the salesman is in much closer contact with the customer and the engineer designing the job. (See Recommendation 3.2) Such a system would free the Engineering Department for the much needed solving of design and production problems.

The Order Service Section with its Chief and two Order Clerks adequately handles the present volume of business. Their present methods of routing and order of work performed is satisfactory. Should an increase in sales volume occur, it is felt that the Chief Order Clerk would become overloaded. This could be avoided by the

elimination of the first review of orders by him. (Figure II-2). Until it becomes impossible for him to handle the work, it is felt that this review does no harm, and in this manner he is kept better informed of the activity of his section.

3. RECOMMENDATIONS

a) It is recommended that the commission agent covering the Los Angeles territory be encouraged to increase his sales force by the addition of two or three salesmen. The sales volume of this area would indicate that the present men covering Southern California are obtaining this large volume by the mere fact of the rapid growth of this area. Now would be the time to cement relations with the customers. When the area again becomes highly competitive Rensselaer men would be the most well known and established in the field.

b) It is recommended also that the Pittsburgh agent be encouraged to hire an additional man.

c) The Texas territory should be investigated to determine the reason for the low sales. It is suggested that the following may be some reasons for this condition:

i) Territory too large for one salesman.

ii) Sales habits of customers. They may prefer to purchase from established jobbers. If this proves to be true, the possibility of obtaining a good jobber may need investigating.

iii) Local manufacturers of products may account for the poor Rensselaer showing. If such a condition exists, the jobber type office may continue the limited sales at a reduced cost.

iv) The present salesman may be unable to meet the Texas customer on the proper terms. The importance of having

the proper type man in each sectional area cannot be over-stressed.

d) It is recommended that the present system of preparing estimates for quotation in the Engineering Department be revised. It is felt that this function is not the primary concern of the Engineering Department but of the Sales Department.

i) Present information available to the engineers, such as operating cylinder size or motor size for a given operation pressure, should be given the salesman. This information could be presented graphically so that the field salesman in most cases could pick the proper size. Prices paid for purchased equipment also could be given to the field man and a fixed mark-up required.

ii) The field salesman should be trained to make his own take-offs of products from the plans and specifications. They could be able then in most cases to quote prices directly.

iii) The Order Service Section with the addition of an engineer or sales correspondent could be able then to accomplish the work which is absorbing so much of the engineer's time at present. Better control could be exercised by the Sales Manager and more prompt service rendered the customer.

When the standard cost system described in Chapter XI is completely in operation, such figures as required above will be readily available. A price book could be compiled listing all standard valves, valves 12" and above, and most special adaptations. Such extras as brass trim,

floor stands and operation cylinders could be included.

e) It is recommended that a commission system be devised for compensation of the direct Company salesman. The higher cost referred to in the appraisal for the Company office appears to be due to two main causes: (i) the tendency for the Company salesmen to give a greater discount to obtain business; and (ii) the higher sales expenses of these men. If the commission system were to incorporate both these items into its scale for monetary returns, they could be corrected.

A system such as salary plus override could accomplish this: set salary on past experience of discount given, the trade in the area and past expenses. Then set a given percentage of commission for all sales over this base volume. The salesmen then would have a real money incentive to increase sales, to decrease expenses and to decrease discounts.

CHAPTER III

ENGINEERING

1. FINDINGS

1.1 SCOPE

In the broad sense it can be stated that nearly all the Company's engineering work now being performed is accomplished by the Engineering Department. This is not to say that this department accomplishes the Company's industrial engineering work. With the exception of some estimating work on quotations the Engineering Department does little work in the field of Methods and Industrial Engineering. Industrial Engineering will be discussed separately in Chapter V of this report. This chapter therefore will be concerned with the functions of the Engineering Department and the duties it now performs.

The Engineering Department consists of the Director of Engineering, the Chief Engineer, three Design Engineers, one Draftsman and one Clerk. The Director of Engineering reports directly to the President. The Director is responsible for the preparation of advertising literature including sales catalogs. He is at present also preparing a monthly newsletter on engineering and other related topics to stimulate interest in and inform the field salesmen of important changes in products.

It must be noted that this department is at present undergoing a major revision. This revision is a slow and expensive operation. In the past engineering in the modern sense of correlating product design, production methods, work standards, production control and production costs was not practiced. Only those items which the shop considered too difficult to reproduce without a drawing were handled by the Engineering

Department. Each shop established its own tolerances, modified existing pieces to fit and otherwise operated on the principle of good shop practices. There existed only assembly drawings and a few standard types. Many parts were not detailed on any drawing but existed in the minds of the workmen or on sketches in possession of the shop foreman.

While this may seem a little harsh it must be remembered that this is an old industry. The products have been produced for decades with little or no changes. Skilled personnel in the shops produced a fine finished product without the aid of detailed drawings or, for that matter, the presence of an engineer. Traditionally this had been an intermittent industry with its high production cost and little repetitive operations. With the increase in the number of valves of this type being used it was realized that a modified repetitive or production line technique could be used. These techniques require integrated planning of the design, production and distribution systems.

At present separate drawings are being prepared for each component listing (a) the kind and size of material requested, (b) all dimensions and dimensional tolerances, (c) all pertinent quality specifications and manufacturing instructions. Separate drawings are being prepared for each assembly, along with the bill of material. The bill of material (8.1) acts as a parts' list and describes and identifies all components in the assembly. Components are being standardized to insure maximum interchangeability of parts. Naturally this job cannot be accomplished rapidly. A good start on standardization has been achieved by standardization of the highly repetitive small valves in the 4" to 12", List 13A sizes. As other valves are redesigned or changed, an attempt

is made to bring them into conformance with the above.

Where in the past shop people did not consult with the engineers as a rule, they now are beginning slowly to consult with the engineers more frequently when technical problems are encountered. It is evident that many improvements in design could be recommended by shop personnel, just as the engineers could recommend improvements in production methods. Mutual interchange of ideas will increase undoubtedly as both parties begin to realize the advantages to be gained by cooperative action. Since habits of long standing are difficult to change, it is felt that the present slow approach of waiting for the shop personnel to call for an engineer is the most satisfactory course to bring engineering to the shops.

1.2 THE WORK OF THE ENGINEERING DEPARTMENT

The work of this department divides itself into three broad and overlapping classifications: (i) preparation of estimates which form the basis of quotations for non-standard products; (ii) the improvements in design and simplification of presently manufactured products; (iii) product development. Each will be discussed separately below.

1.3 PREPARATION OF ESTIMATES

As described in the sales section of this report, when a request for quotation is received, it is reviewed by the Sales Department and then forwarded to the Engineering Department for preparation of detailed estimates. When the plans and specifications for a contemplated waterworks installation are received, the Chief Engineer examines them carefully and lists the equipment on which Rensselaer Valve can bid.

All deviations from standard are noted along with such necessary information as working pressures and the number of cycles the valves are operated daily. A quotation worksheet (3.2) is used to insure that no item is overlooked. To the base price for a standard valve, obtained from the cost accounting system, all cost modifications are added.

These cost modifications are arrived at by estimating the number of hours involved in making such changes from standard as are required. These hours are then multiplied by the cost per standard hour for the shop involved. Weight changes are estimated and a cost figure added for this change. The Chief Engineer has built up a set of these cost changes over the past years which seem to cover most cases. This information is in his possession in the form of tables and notes.

1.4 IMPROVEMENT IN DESIGN

The second function of the Engineering Department is by far the largest single job which faces the Depatment. While it is called review and modification of present products, it is in actuality the complete rework of the past thirty years' endeavor.

Every product needs to be investigated to simplify and improve construction, standardize components to give maximum interchangeability of parts and reduce weight. The designs are being reviewed to eliminate unnecessary manufacturing expense and at the same time to improve functional utility of the product.

A standard drawing system is being incorporated to simplify the identification of components, pattern, subassemblies and assemblies. A bill of material listing all components of each product is being prepared.

These bills of material are about 70 percent completed at this time; and since they are the basis upon which the material control and cost control system are built, they are being prepared as rapidly as possible.

All orders requiring engineering information are received by the Chief Engineer for review. They are then given to an engineer for study. The drawing files are checked to see if an exact duplicate has been produced in the past. If one had been produced, the old drawings are checked to see if any improvements in design or manufacturing can be made. If new drawings are required, the Chief Engineer is informed and approval for redesign is given. Most work in this process is minor modification of present drawings. Upon completion of assembly drawings a bill of material is made. As stated above, standard components are used wherever possible. If standard components cannot be used, detailed drawings and sketches are prepared. These detailed drawings and or sketches along with the bill of material are sent to Production Scheduling for distribution to the shops involved.

From time to time reports are received from the field that a valve failure has occurred either upon pressure acceptance test or during operation. Whenever a valve failure occurs, the Engineering Department is given the problem and expected to redesign the valve to correct the defect, provided that the fault did not occur during manufacturing. This redesign usually requires that the valve be strengthened at the point of failure. At present the Engineering Department makes the best estimate of the cause of failure without experimental verification of the exact location of the high stress area nor the amount of stress in the suspected area. In the redesign of the casting the stresses are calculated as

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closely as possible. After completion of the design the casting is made in the foundry. The castability is checked by visual inspection and by design pressure tests. In some cases the casting is cut through or drilled at points os suspected inferior metal, such as internal porosity or hot tears. Radiographic means are not available to check the casting for possible shrinkage or gas porosity. When the casting is considered sound, the foundry continues to make similar castings. Only when valve failure reports involving the casting are received again does the Engineering Department check the casting for strength.

Since the redesign is made without experimental verification of the actual stress and location of these stresses, usually additional metal is added at the area of failure. The weight of such castings has been increased over the years. Considering the significant need for quality at all times and the expense of additional metal, it would appear that experimental stress measurements of suspected valve casting would be made.

Henry Ford said the following about excess weight: "Most of the articles we use are too heavy. The sheer weight of things has increased cost and hindered advancement - like the old castles abroad that cannot be modernized. With the materials now available we can replace these things with lighter and superior articles. New materials enable us to discard the theory that only weight means strength".

1.5 PRODUCT DEVELOPMENT AND DESIGN

The Engineering Department is developing new products for manufacture. While principal efforts are being directed along traditional

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lines, that is valves, hydrants and accessories in the transmission of water, other lines are being considered.

Designs are being developed for a low cost hydrant, an improved air valve and a balanced butterfly type valve among others. As these designs are developed, patents are being applied for to protect the superior operating or manufacturing features intended.

While the development engineering is small at present, it is considered of prime importance if the Company is to continue to gain in the waterworks field. The growing necessity of filtation plants and sewage disposal plants with the increase in the population of America is causing a technological change in this industry.

2. APPRAISAL

2.1 ESTIMATING

At present the manufacturing cost estimates arrived at by the Engineering Department appear to be only approximations of the true cost. Until true standards of work measurements are developed and used, they will continue to be only estimates and subject to wide variance. The need for a cost control system along with accurate standards of work is more important in estimating new work than in any other place. When costs and work standards are available for standard components, the estimate can be built up with the minimum of estimation and the maximum of accuracy.

It is believed that the majority of the modifications requested by customers could be priced accurately and included in the price book of the Sales Department. This would allow the salesman to price most products. The Engineering Department would be free then to concentrate its full efforts toward solving the many technical problems which are pressing.

2.2 IMPROVEMENT IN DESIGN

As was pointed out in FINDINGS, this important function of the Engineering Department is progressing slowly but satisfactorily. Any drastic measure to force closer cooperation between the shops and engineering probably would cause more animosity between the two. It is believed that the Director of Engineering has accomplished as much as possible in the short time he has been with the Company.

2.3 PRODUCT DEVELOPMENT

The product development functions are being performed satisfactorily at this time. It is obvious that no separate research and development department can be supported by a company of this size. The new products being developed are considered necessary. As much time as possible must be devoted to the development of new products which can take up the slack due to the seasonal fluctuation in the waterworks industry.

It should be emphasized, however, that any cast-iron or cast-brass product, or an approximate combination of them, which would utilize present idle capacity, could be a potential Rensselaer Valve Company product even though it is not a valve.

3. RECOMMENDATIONS

(i) The Director of Engineering must continue to receive the strongest support by top management in the program of design, standardization, quality improvement and development which he has undertaken.

While it is difficult for the survey group to evaluate the progress being made, the absolute necessity for modernization of engineering practices, if the Company is to continue to grow, is apparent. The necessity of hiring additional competent engineers is at present doubtful. As the Department is called upon more and more by the shops to assist in solving technical problems, the need for additional engineers may become necessary.

(ii) Every effort must be made to increase the strength of valves and at the same time to reduce their weight. As mentioned in FINDINGS, it is believed that continued addition of metal has been made in attempting to overcome failures due to highly stressed sections. If a casting is so designed that a section is highly stressed, the addition of metal may cause a greater concentration of stress. Without experimental verification of the location of these high-stressed areas in a completed casting, it is difficult to design properly.

Since such experimental verification can be accomplished only in a laboratory with modern equipment, it is suggested that the services of the Mechanics Department of Rensselaer Polytechnic Institute in Troy, New York be solicited to assist in the investigation. Complete stress analysis of a valve or series of valves might reveal a design where as high as 50 percent of the weight might be reduced without sacrifice in

design strength. This saving could recover the cost of such an experiment in a very short time and prove a continued source of revenue, along with the advantage of an overall increase in the quality of products.

CHAPTER IV

PRODUCTION FACILITIES

1. FINDINGS

1.1 FOUNDRY (See Appendix 4.1 - Plant Layout)

The Iron Foundry is centered around two 96-inch cupolas lined to a 42-inch diameter. The cupolas are used on alternate days and have a capacity of about 8,000 pounds of cast iron an hour. Current operations require about 25 to 30 thousand pounds per day. Casting sizes now are limited to about a 36-inch valve case as a result of the reduced cupola size. Cupola charging is accomplished mechanically.

A monorail at each line molding station provides for the moving of empty flasks to the molding machines. A jib crane hoist moves the completed molds from the molding machines to the roller conveyor. Hoists are air-powered. A specially adapted fork lift truck pushes the molds into the pouring area and onto shakeout. From shakeout castings are hand-trucked to the cooling area. From the cooling area castings are again hand-trucked to the cleaning area. Castings up to thirty inches are processed through a wheelabrator. Power tools are used for cut-off, chipping and grinding.

A mechanical shakeout and sand reconditioning and delivery system provides sand overhead at each line molding machine by means of a belt conveyor and hopper system. Hydrants and valves, 12 inches and less, are line molded. Other castings are floor molded, poured and shaken out without the benefit of mechanical assistance other than pneumatic tampers and a bridge crane. Sand used in floor molding is re-

conditioned by a Clearfield Muller and is moved in skip boxes by crane.

The coremaking benches and ovens are located in the center of the foundry opposite the cupolas.

The Brass Foundry is located at the south end of the Iron Foundry. It is not mechanized to the same extent as the Iron Foundry. Two tilting furnaces, each with a capacity of 1,000 pounds per day, provide molten brass for molds produced on six molding machines. Sand is handled manually throughout the process. Large castings are molded and poured on the floor of the Iron Foundry. The Brass Foundry is currently considered by the Company to be operating at maximum capacity and at such rate is producing from 75 to 90 percent of its brass requirements. The balance of the requirements come from local foundries.

1.2 MACHINE SHOPS

These shops are organized on a modified functional or process type basis into several specific shops according to size and/or type of product manufactured. Special adaptations of machine tools have been made in order to meet the requirements of quantity production of the Company's products.

Old Machine Shop. The principal task of this shop is the production of valves up to and including 12 inches.

Big Machine Shop. Large valves, those over 12 inches, and tapping sleeves are the major products of this shop.

Upstairs Machine Shop. This shop machines and assembles parts for all cast iron valves 3 inches and smaller including all brass valves. Valve stems for 24-inch and larger valves are machined here also. This shop also performs a maintenance function that will be described in

Chapter VI. All machine shop jigs and fixtures are made in the Upstairs Machine Shop.

Hydrant Shop. This shop machines, assembles, tests and paints all hydrants.

1.3 PATTERN SHOP

About ten percent of the patternmakers' time is spent in fabrication of patterns for newly-designed parts while the remainder is occupied in such tasks as replacement of worn or damaged patterns, repair of damaged patterns and coreboxes, and changing patterns for floor molding operations. In addition to normal woodworking tasks the pattern shop carpenters sometimes assist in plant maintenance.

There exists a backlog of considerable magnitude of pattern work which consists primarily of new pattern requirements and pattern repairs. An additional backlog of work exists in the cataloging and storing in a systematic manner the patterns and coreboxes now stored in numerous places without a catalog or finder system. Patterns and coreboxes are now stored in the loft above the Upstairs Machine Shop, in the loft between the main building and the Upstairs Machine Shop, in three places in the Iron Foundry, in the Brass Foundry, in the two buildings to the north of the foundry and in a building in Cohoes rented for this purpose. It is the policy of the Company to be able to furnish repair parts to all its valves.

Orders for new patterns can be issued by the Pattern Shop Foreman, the Foundry Superintendent and by the Engineering Department, and must be approved by the Vice President of Manufacturing.

The Pattern Shop Foreman requisitions lumber for all Company operations. Lumber for patterns is in the custody of the Pattern Shop Foreman and is stored in the loft above the shop. All other lumber is stored uncovered in the yard. Lumber can be withdrawn by anyone without permission from the Pattern Shop.

1.4 MATERIALS HANDLING

Coke, limestone, pig iron and scrap iron are delivered by rail to stock piles along the east side of the foundry. Chutes deliver materials to the charging bucket where they are manually loaded. A power winch hoists the loaded bucket to the charging level where the bucket is moved on a monorail to either cupola and dumped mechanically.

An electric truck moves flasks on skids from shakeout to molding stations.

From shakeout to storage castings may be handled by one of several methods including hand-truck, pallets on a fork lift, tote box or skid on an electric truck. Routes followed in moving castings to storage areas are indirect and time consuming.

Finished castings are moved from storage in the yard to production areas by electric truck, fork lift or both. A shortage of skids necessitates loading some parts on pallets. The fork lift then loads the pallets onto the electric truck, follows the truck into the shop and then unloads the pallets at their destination. The same procedure is used in moving the parts out of the machine shop to the assembly area.

An elevator provides the necessary access between the basement, ground floor and second floor of the old building. An elevator

is used to move brass ingots and scrap to the brass foundry.

Lumber for patterns is moved manually to the loft above the pattern shop for storage.

1.5 MATERIALS STORAGE

Small castings are stored in the basement in bins with little or no system in use to mark or identify bins and parts location therein.

Purchased parts are stored in the basement stockroom in bins, barrels and boxes in much the same manner as the small castings.

Lack of covered space has necessitated placing a large amount of finished castings in storage in the yard. No systematic method for storage is used in this area. Castings moved into the area are placed at the first open space. Considerable difficulty is experienced in locating castings covered with snow.

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2. APPRAISAL

In general the facilities for manufacturing at the Rensselaer Valve Company can be characterized as comparatively modern. Although the buildings are old, there is exhibited a fair degree of mechanization, some modern tooling and equipment. This company is in a favorable position in this respect as compared with two of its local competitors.

In order to evaluate the ability of the Company to produce effectively, the manufacture of a representative product, the List 13A 6-inch mechanical joint valve, has been selected for study and appraisal. Because the quantity of 6-inch valves sold in 1953 amounts to about 50 percent of all valves sold in 1953, this appears to be the most likely activity to examine for possible economy. While accounting for 50 percent of the quantity sold, the 6-inch valves accounted for 17 percent of their total sales.

A process flow chart for the analysis of the manufacture of the valve selected for study is presented as Appendix 4.2. As there has been a fair degree of mechanization accomplished in the Iron Foundry, the study will start with the component finished castings and purchased parts in storage.

An examination of the process chart reveals that the 25 different parts of the valve are transported a distance in excess of two miles (12,353 feet) from storage through machine operations and assembly to the shipping floor. Parts are moved 163 times and are placed in temporary storages 149 times while 50 different operations and 13 inspections are performed. Such figures are characteristic of the functional type of plant layout. With components being processed in batches or lots, large storage areas are required at each production center. Materials

are transported with some difficulty and confusion because production centers are crowded and aisles are narrow. Much of the process time is consumed in transportation and in waiting for transportation. Consequently large in-process inventories result which require excessive amounts of working capital. Also characteristic of this type of layout, supervisors must maintain very close attention to all operations on all parts in order to keep production centers loaded.

Normally the time required to produce a lot of 100 6-inch valves of this type will range from about two to four weeks from the time the valves are scheduled for production by the Production Manager to the time they are placed on the shipping floor. A period of about four or five days is required to complete a lot in the machine shop. Actual Machine Shop production time required is about $1\frac{1}{2}$ man-hours. Expressed otherwise, 96 percent of the valves' time in the machine shop is occupied in moving or waiting to be moved. Processing time in the foundry is about three or four days for a lot of 100 6-inch valves.

In order to reduce the distance moved and the number of operations, transportations, storages and inspections, the use of a production line is proposed. Appendix 4.3 is a proposed layout of a production line in the Old Machine Shop for the manufacture of List 13A 6-inch mechanical joint valves. All major machinery called for in the proposed layout is currently in use. Appendix 4.4 lists the modifications necessary to put the plan into effect. Appendix 4.5 is a load chart indicating work stations, operations times, and so forth. In balancing the work load for each machine the existing production line standards were used with some minor modifications.

The following table is a comparison of the present and proposed methods:

COMPARISON OF METHODS

	Present	Proposed	Savings
Operations	50	42	8
Transportation	163	36	127
Storages	149	35	114
Inspections	13	8	5
Distance Travelled	12,353	4,930	7,423

The proposed method will allow a lot of 100 valves to be processed in the machine shop in one day instead of the present four or five days. The value of machine shop work-in-process in the proposed method is reduced approximately $4,400 or to 97 percent of its present value.

With minor modifications the proposed production line for 6-inch mechanical joint valves can be adapted to the production of 4-inch and 8-inch mechanical joint valves. Four inch through 8-inch hub type valves also could be produced on the proposed production line by simply omitting the drill ends step. The modifications necessary to accomplish this versatility are listed in Appendix 4.4. Further modification would permit also the manufacture of flange type valves on the proposed production line.

The proposed layout is not completely suitable, i.e., all machines do not have adequate capacity for the manufacture of 10 and 12-inch valves over the entire production line. By using part of the line, particularly the assembly end, however, some economies could be

affected in the manufacture of these valves.

Two areas with potential savings not studied in detail in this survey but considered an integral part of it are (i) the moving of finished castings from the foundry to storage in the yard or basement, and (ii) the dipping process and location of it. The move from the foundry to the yard is over a circuitous time-consuming route of about 700 feet in length. The distance to the basement is not so great but involves the use of the elevator. With the installation of the production scheduling system proposed in Chapter VII components for 4 to 12-inch List 13A valves will proceed directly from the foundry to the machine shop via the dip tank. In order to eliminate the long moves from the foundry to the dip tank and from the dip tank to the machine shop the relocation of the dip tank is considered highly desirable. The following is a possible remedy for the situation. In order to increase the capacity of the brass foundry and to increase the area now desired for shakeout and cooling in the Iron Foundry, it is proposed to build on the premises a new brass foundry of larger capacity. In view of the fact that the present investment in the Brass Foundry is small, however, the Company should consider the possibility of closing its own foundry and buying all its brass casting requirements elsewhere. In the event of either action the desired additional area for cooling and shakeout could be obtained, chipping and cleaning could be rearranged and the dip tank could be relocated in the area where the Brass Foundry now is located. The following sketch indicates that the rearrangement thus attained would permit a direct move of finished castings from the foundry to the machine shop.

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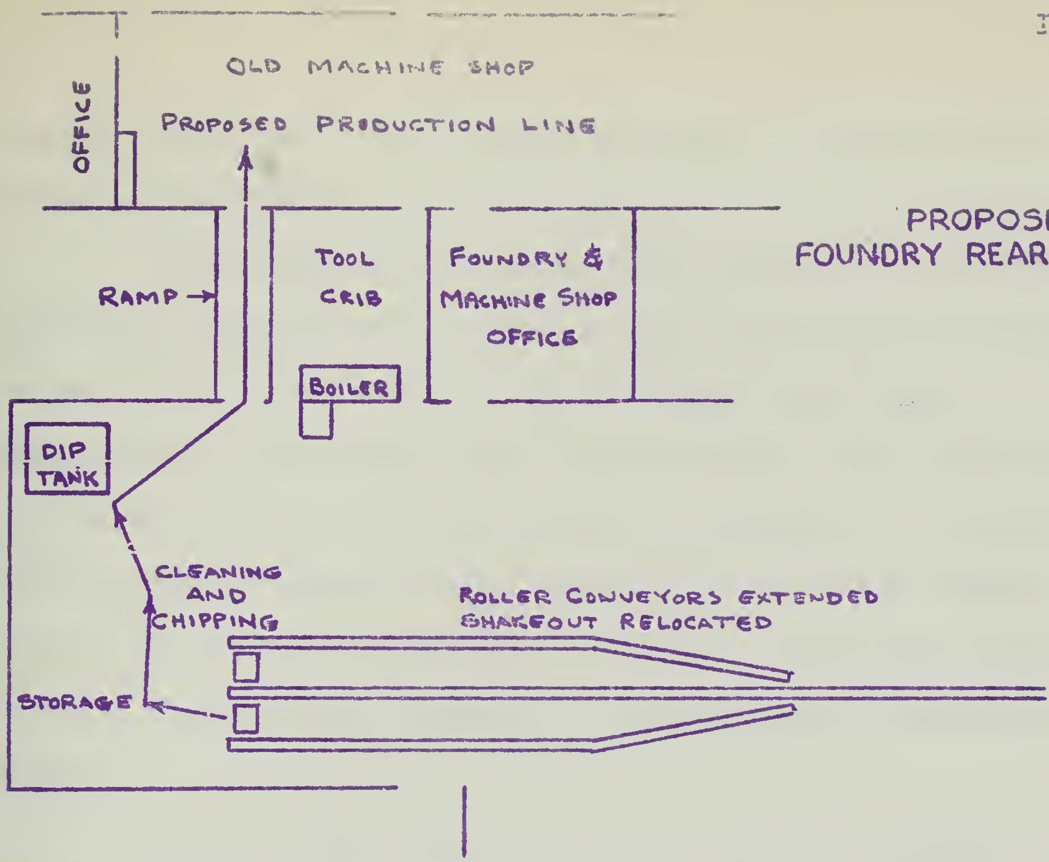


PROPOSED
FOUNDRY REARRANGEMENT

The above proposal, if accomplished, would reduce the distance travelled by the valve parts in the proposed production line arrangement from 4,900 to about 3,800 feet in addition to eliminating the 700-foot move from the foundry to the dip tank at its present location. A continuous mechanical type of dipping should be installed to speed up this operation.

It always must be borne in mind that the manufacture of List 13A valves 4 to 12-inch sizes is the mainstay of the Company's existence. The sales of these valves accounts for about 36 percent of the Company's revenue while their production amounts to 52 percent of the total number of products produced and sold (1953 figures). It is of paramount importance, therefore, that all production facilities be arranged to produce List 13A valves, 4 - 12 inches, in the most effective manner.

Hydrants, representing 17 percent of last year's sales, are

another product that would lend itself readily to production line techniques of manufacture.

With patterns and coreboxes now in storage in at least nine different places including a rented storage, the situation would appear to need some detailed study. While the Company may take great pride in being able to furnish repair parts for old valves, it is questionable whether all patterns should be retained indefinitely. It is possible that the cost of pattern storage exceeds the cost of a new pattern. In addition to the space requirements for storage, considerable time is expended in searching for patterns not systematically catalogued and stored.

As previously mentioned in this report, the Rensselaer Valve Company is considered to be the most modernly equipped valve manufacturer in this area. Even so there is much more to be accomplished with respect to modernization. The fact that the Company has made no appreciable investment recently in modern plant equipment, coupled with the possibility that the plant may be moved to another location has been a significant deterrent to increased productivity. Facing the possibility of a shutdown and always in fear of running out of work, the labor force has created an attitude that production must be limited. The Company can overcome this attitude only if it is willing to demonstrate in a very tangible form its faith in the future. Specifically, such evidence must be in the form of investment of appreciable funds in new and improved equipment, methods and processes. If there is no future, the Company should give serious consideration to the development of other products not necessarily allied to its present products.

3. RECOMMENDATIONS

(i) Devise a comprehensive long-range program for the improvement and modernization of plant equipment, facilities, processes and methods. Initiate this program as soon as possible and prosecute to the limit of the Company's financial ability.

(ii) Embody in the long-range program the proposal of this chapter to manufacture List 13A 4 - 12-inch valves and hydrants on a production line basis.

(iii) Give careful consideration to the suggestion pertaining to the cost of storing patterns.

CHAPTER V

INDUSTRIAL ENGINEERING

1. FINDINGS

Until recently the Company has had on its staff an industrial engineer who performed duties in connection with determination of production time standards, production methods and plant layout. At present the responsibility for formal studies in this field is unassigned. Production planning now is accomplished informally as the occasion demands by those immediately engaged in the consideration of specific production problems.

About three years ago a firm of management engineering consultants studied Company operations and set production time standards. This study did not include methods standardization. These standards have served as the basis for the Company's wage-payment plan.

As a result of an agreement between the Company and the unions the Company will not use a timing device for the determination of a production time standard. New standards are set by collective bargaining between union representatives and the Shop Superintendents or the Vice President of Manufacturing. The basis of such standards is past performance on similar operations. No formal attempt is made to standardize and record in detail the new method.

Grievances dealing with production time standards are infrequent.

The worker can limit his output. An assembler reported that the output for the shift would be limited to 102 6-inch valves regardless

of the amount of time remaining in the shift after the quota of 18 percent above base rate had been reached.

Union representatives expressed a strong disapproval of production time standards. Their dislike appeared to be very deep-rooted and stemmed from alleged abuses in the determination and application of production time standards. The alleged abuses reported were those universally expressed (oftentimes justifiably) by labor in the criticism of stopwatch standards such as rate cutting and attempted speed-up.

2. APPRAISAL

While there is some evidence of well-planned mechanization in the iron foundry, the impression made as the result of this evaluation of the Company's manufacturing facilities is that the present general state of obsolescence throughout the plant is primarily the result of management's casual approach to production planning problems. Somehow the everyday exigencies of operating a manufacturing establishment occupy management's time and leave little or no time for adequate consideration of production planning problems. There is also an apparent lack of awareness on the part of management that the implementation of well-prepared plans for methods improvement, plant layout, product flow and so forth pays dividends in the form of increased output and lower production costs. The present method for the manufacture of a 6-inch valve as shown by Appendix 4.2 is characteristic of many of the Company's manufacturing processes where inefficiencies have been permitted to exist.

As an adjunct to the Vice President of Manufacturing an experienced engineer whose sole duties would be to advise the Vice President of Manufacturing in such matters as methods improvement, work measurement, plant layout, production control and materials handling could materially assist in the reduction of production costs throughout the entire manufacturing process. In line with the comments of the preceding chapter this engineer would be responsible for the detailed planning of the proposed long-range comprehensive program for the improvement and modernization of plant equipment, facilities and methods.

The agreement of the Company with the unions to refrain from the use of the stopwatch for the purpose of setting production standards has prevented this survey group from evaluating the adequacy of the standards now in use. However, some observable characteristics of performance as reported in paragraphs 4 and 5 of FINDINGS indicate that time standards are generally loose. It is common knowledge that workers will protect lenient standards of production by regulating their output so that there is a fixed relationship to standards. A practice like this is sufficiently widespread so that many poorly conceived time study procedures and wage-payment plans often appear to be functioning well. It appears then that the Company's production time standards should be reevaluated. Investigation also should be made of the wage-payment plan as to soundness of principles embodied therein. Are adequate earnings provided for the average individual? Are operators protected against incidental losses of time? Is the optimum incentive effort attained? Has the range of human abilities been taken into full account? Are standards guaranteed without limitations on earnings? Engineered standards are the prime requisites to the answer to these questions.

3. RECOMMENDATIONS

(i) Create the position of Production Engineer to serve as an assistant to the Vice President of Manufacturing and to be responsible to him for the development of, through the application of fundamental principles, precise standards of performance with respect to:

a) production processes

b) production procedures

c) production methods

d) plant layout and maintenance

e) production times and quantities

Appoint to this position an individual trained and experienced in the field of industrial engineering and capable of directing in detail the plant improvement program recommended in the preceding chapter. He should be well qualified in work measurement techniques and methods engineering. He should possess the personal qualities necessary to convince management, supervision and workers that improvements are necessary in order to remain in a favorable competitive position. A properly qualified person could be obtained probably for about $7,500 per year. It is possible that the same individual could perform the Quality Control Engineer's functions as recommended in Chapter IX.

(ii) Reevaluate production time standards as a part of the overall long-range plant improvement plan. Appendix 5.1 discusses a method of time study to replace stopwatch techniques. Concurrently with the time standard reevaluation, existing manufacturing methods must be brought under close examination for possible improvement in materials, processes, tools and equipment, and workplace and motions.

CHAPTER VI

PLANT ENGINEERING AND MAINTENANCE

1. FINDINGS

There is no formal plant engineering section in the Company. The functions of the Plant Engineer other than maintenance are exercised by the Superintendents of the Foundry and the Machine Shop. The Foundry Superintendent is responsible for the proper functioning and routine upkeep of all the equipment in his shop, along with general housekeeping. The same is true of the Machine Shop Foreman. A layout of all equipment in both shops was prepared by the previous Plant Engineer who retired in 1953 and whose position has not been filled. This chapter will deal therefore with the maintenance of equipment only.

The maintenance duties are divided into three parts. The machine tools in the machine shops are under the cognizance of the Foreman, Upstairs Machine Shop. All other equipment with the exception of major repairs to patterns is under the Foreman, Maintenance Shop. Pattern repairs requiring the assistance of a patternmaker are made by the Pattern Shop and are covered in Chapter IV dealing with production facilities.

1.1 MACHINE TOOL MAINTENANCE

All repairs and maintenance of machine tools for the machine shops are made under the supervision of the Foreman, Upstairs Machine Shop. This includes lathes, milling machines and so forth, along with jigs and fixtures for these tools. Metal patterns for the foundry are repaired by this shop also. Normally three or four machinists are kept

busy with such repairs and maintenance.

No records or machinery histories are maintained for the machines. While the productive workers of this shop are engaged in repairs or maintenance, their time is charged to the shop requesting their work; for the machinists in the Upstairs Machine Shop are both productive workers and maintenance workers. Productive machinery also is used when necessary to make parts and other items for repairs. It was reported that many times repairs to equipment for other shops have been given low priority due to the repair machinist or the machines being employed in productive work. Although producing valves is the primary purpose of this as well as other shops, prompt repairs also are necessary if the overall productivity of the plant is to be maintained.

Routine greasing and oiling of machine tools is the responsibility of each operator. Each shop foreman is required to enforce this rule. Greasing and oiling of motors, line shafting and other equipment in all shops come under the Foreman, Maintenance Shop as described below.

1.2 MAINTENANCE SHOP

As stated above, the Maintenance Shop is under the direction of the Maintenance Foreman who reports to the Superintendent of the Machine Shop. He is responsible for the repairs and maintenance of all equipment other than machine tools in the Machine Shops. The shop consists of the Foreman, four machinists, two electricians, one carpenter, one oiler and one welder, and is considered part of the Machine Shop for group incentive pay.

A greasing and oiling schedule for each piece of equipment requiring this service is maintained. The schedule conforms with the directions of the equipment manufacturer and is adhered to closely. The greasing and oiling are done by the oiler.

A looseleaf record is kept showing major repairs and overhaul of all major machinery and equipment. This record shows the date and type of work done, along with the number of man-hours spent to repair or overhaul. The record is up-to-date and with the greasing schedule makes up a good machinery history of the equipment. The record is not an accounting record but is kept to assist the Maintenance Shop in predicting when repairs will be required. It also acts as an appraisal of different manufacturers of the same type machinery. Costs of repair parts are not kept by the Maintenance Shop. These cost records are part of the price history which the Purchasing Department keeps for each piece of machinery.

The maintenance carpenter does miscellaneous jobs required around the shop and also small repairs to wood patterns which do not require a patternmaker.

While this shop carries the welder as a member of the team, it is reported that he spends most of his time on production work. Most of his expense is borne by the Machine Shop by transfer payment.

While no planned maintenance other than greasing and oiling is practiced, the looseleaf record kept for each piece of machinery does assist the Foreman materially in predicting breakdown. He is well acquainted with all the equipment and by referring to the record can estimate repair part requirements and workload with a fair degree of accuracy.

At present the maintenance gang is kept busy making necessary on-the-spot repairs to faulty equipment. Little time is available for routine upkeep or overhaul other than greasing. Since the responsibility for the correct operation of all production machinery lies with the cognizant shop supervisor, Maintenance usually is called after serious trouble has developed. Many times failure of the shop operating personnel to inform Maintenance of difficulties which are just appearing has led to serious failures which have disrupted production. Each cost center is not charged directly for the repairs to its equipment, but the cost of maintenance is distributed to each by a predetermined estimate.

[illegible]

2. APPRAISAL

The present maintenance practices seem satisfactory for a p plant of this size. The Maintenance Foreman appears well acquainted with all his machinery and maintains machinery histories and greasing schedules. The records of machinery seem complete and accomplish the desired results of assisting the Foreman in outguessing breakdowns and spare part requirements. Management is aware of the increased cost of operating and repairing old equipment so the need for cost records for such purpose does not appear necessary. Since the Supervisors of the shops are well aware of the shortcomings of some machines, they need not refer to maintenance records to determine where to spend their budget for new equipment.

While the maintenance practices are satisfactory, it would appear that some organizational changes might improve the services rendered to other shops. The present system of having the maintenance of machine tools and other equipment separated under different shops seems to this survey group to be rather cumbersome and to a certain extent to interfere with orderly production. Without a more thorough study of the proportional time devoted by the machinists in the Upstairs Machine Shop to repair work and production work, it was impossible to determine whether all maintenance and repair work should be consolidated under one supervisor. Some mention was made by personnel that repairs were held up due to machines and/or the machinists being employed on productive work done by the Maintenance Shop. The Maintenance Shop could be equipped with machine tools for the express purpose of repair

work and thus would not interfere with production. If the workload on repairs approaches that reported, two or possibly three machinists could be transferred from the Upstairs Machine Shop to handle all repairs required on machine tools and fixtures.

It is evident that more than fifty percent of the present work of the Maintenance Shop is done for the Foundry, even though the Maintenance Shop is under the Machine Shop's incentive plan. This situation would appear to foster the complaint heard that repairs to foundry equipment are slow because the repair men have no incentive to rush foundry work. While this may not be true, it would seem a better plan to figure incentive pay for the maintenance workers on the average of both incentive groups. Better service might be obtained for both groups since an incentive would be present for good service on all repairs.

Further improvement of repair service to the foundry would be possible if the Maintenance Shop were placed under a supervisor common to both shops or under a supervisor responsible to keep production high in both shops. At present with the Foreman of the Maintenance Shop reporting to the Supervisor of the Machine Shop it is only natural that the most pressing Machine Shop work would be given precedence. Chapter V of this report recommended that a Production Engineer be employed to supervise methods and industrial engineering. It would appear that consideration should be given to placing the Maintenance Shop under his supervision.

The present system of distributing all maintenance costs by a predetermined estimate does not seem to emphasize to the foreman in

charge of the cost centers the necessity of proper machine tool upkeep to prevent costly repairs. If all major repair costs were charged directly against the center accruing the charge, it is felt that an improvement in daily upkeep and care in operation of equipment would be experienced.

3. RECOMMENDATIONS

i) Maintenance Shop, including the Firemen-Watchmen, should be placed under the Production Engineer in order that better service be rendered to both the Foundry and the Machine Shop.

ii) Consideration should be given to establishing a job order system for all repairs costing over fifty dollars. These charges should then be charged directly against the cost center incurring them.

iii) If possible the Maintenance Shop's incentive pay should be computed on the average of all groups which it serves. This would eliminate the accusations of trying to make the percentage for their own group while neglecting the others.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

CHAPTER VII

PRODUCTION SCHEDULING AND CONTROL

1. FINDINGS

1.1 ORGANIZATION AND FUNCTIONS

Production scheduling and control is accomplished by the Production Manager and his staff. This staff consists of an Office Assistant, a Machine Shop Production Foreman, a Foundry Production Foreman, a Material Control Foreman, two Production Clerks, a Storekeeper and two Stock Handlers. The Production Foremen in the machine shop and foundry and the Material Control Foreman are not foremen in fact, but in title only.

1.11 PRODUCTION MANAGER

The Production Manager is responsible for supervision of his staff, for predicting shipping dates and for scheduling work in such a manner that these dates can be met in the most economical manner. He also determines what work will be accomplished by contractors if such, in his opinion, becomes necessary. It might be noted at this time that all valve cases and covers for 36" and larger valves are cast by outside contractors. The Production Manager also conducts a weekly supervisor's conference. This conference is attended by the general superintendent of the machine shops and of the foundry as well as by all subordinate line and staff supervisors. The topics dealt with at this conference pertain to manpower and machine utilization, quality of product, housekeeping, supervisory development, and any problems that those in attendance might wish to discuss.

1.12 OFFICE ASSISTANT TO THE PRODUCTION MANAGER

The Office Assistant to the Production Manager records incoming

orders, assists in the preparation of the monthly schedules, assumes the responsibilities of the Production Manager in his absence, investigates and provides information relating to all customer inquiries regarding status of orders, initiates orders for certain types of materials obtained by purchase and acts as general assistant.

1.13 MATERIAL CONTROL FOREMAN

The Material Control Foreman is responsible for determining monthly material requirements for all products to be manufactured except 4" - 12" miscellaneous valves, hydrants and valves over 12". Material requirements for valves under his control are determined by comparing the items required for scheduled production with stock on hand based on a monthly physical inventory. In conference with the Foundry Production Foreman and the Foreman of the Old Machine Shop the monthly material requirements are allocated on a weekly basis. After the weekly schedule has been determined and production started, he advises the Foundry Production Foreman daily of critical items that have been scheduled for delivery but not yet received. This information is provided in the form of a Rush List and is used to expedite material through the Cleaning Room.

He is also responsible for maintaining stores and supplies and for submitting requisitions to the Purchasing Department sufficiently in advance to provide for timely procurement and for maintaining stocks at the most economical level. He is assisted by a Production Clerk, a Storekeeper and two Stock Handlers.

1.14 PRODUCTION CLERK

A Production Clerk, located in the Production Manager's office

and working directly for him, maintains a stock file on components for all valves over 12" and for 4" - 12" miscellaneous valves, check valves and tapping sleeves. As Bills of Material for large and miscellaneous valves are received from the Engineering Department, this clerk checks their requirements against stock on hand and indicates any shortages directly on the Bill of Material. This Bill of Material is then forwarded to the Foundry Production Foreman who uses this information as a basis for his foundry production schedules. This clerk also performs typing and other routine clerical duties for the Production Manager and his staff.

1.15 FOUNDRY PRODUCTION FOREMAN

The Foundry Production Foreman is responsible for scheduling work to the iron and brass foundries in such a manner that material will be provided the machine shop in sufficient time for production schedules to be met and at the same time to utilize foundry manpower and equipment at their optimum. He is also responsible for determining pattern requirements and for submitting these requirements to the Pattern Shop sufficiently in advance to provide adequate delivery time. He compiles a daily foundry production record which gives the daily total output per foundry worker and his percentage of standard productivity. The expediting of the items on the daily Rush List through the cleaning and chipping room is also accomplished by the Foundry Production Foreman in conjunction with the Chip and Clean Foreman.

1.16 MACHINE SHOP PRODUCTION FOREMAN

The Machine Shop Production Foreman is responsible for the detailed scheduling of the work involved in the manufacture and assembly

of miscellaneous 4" - 12" valves and all valves over 12" in such a manner that scheduled shipping dates will be met with the minimum outlay of labor and a maximum utilization of equipment. He is responsible for providing the individual work stations with materials, for determining machine capacities, machine loading, shift work and overtime requirements, if any, and for advising the Production Manager if the scheduled work is in excess of available manpower or machine capacity. He is also responsible for advising the shop foreman of the order of priority in which machines will be manned in event the work force is not sufficient to man all machines. He determines the work station routing and collaborates with the shop foreman in order to provide an even flow of the materials in-process from one work station to the next.

1.2 INCOMING ORDERS

As orders are received in the Sales Department the master ditto is forwarded to the Production Department. The Production Manager or his Assistant indicates a shipping date on the master order form. After recording of this order in the appropriate production order book or books, it is returned to the Sales Department. Form M518 (7.1) is used to record the order information. These forms are bound in a loose-leaf folder to make up the order books. The Production Manager estimates shipping dates from a knowledge of the backlog of work on hand, lead time required for material procurement, and the estimated time required to manufacture the particular valve in question.

In the case of orders for valves that are of an unusual nature, concurrently with the master ditto being sent to the Production

Department, a copy is run and forwarded to the Engineering Department. Upon the return of the master ditto from the Production Department the Sales Department makes copies and distributes them in accordance with Figure II-2.

The Engineering Department upon receipt of its copy of the order prepares the necessary drawings and Bills of Material and forwards them to the Production Department for the required distribution, Chart 7-1. This information generally is provided from four to six weeks prior to the scheduled shipping date. The Engineering Department has available standard Bills of Material which they modify by additions or deletions to provide a Bill of Material for the particular valve in question.

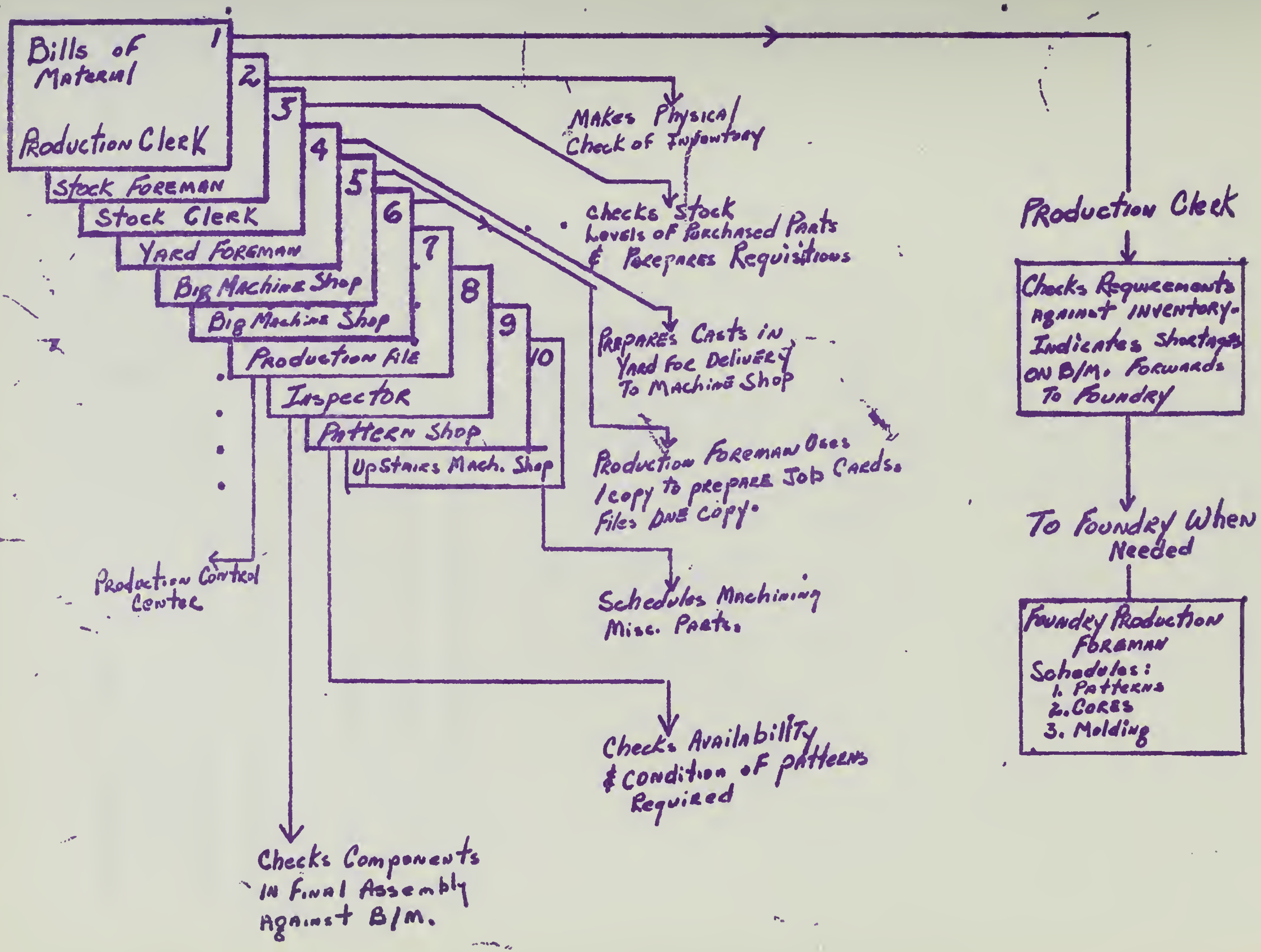
1.3 SCHEDULES PREPARATION AND ISSUE

The Rensselaer Valve Company operates on a standard twenty working day month. All work is scheduled on this basis.

At the beginning of the last work week of each month the Production Manager and his assistant start the preparation of schedules for the work to be accomplished the following month. A separate schedule is compiled for each basic type of valve. They are distributed as follows:

4" - 12" Misc., 14" - 48", Check, Air, 2" - 3", Brass Valves, Tapping Sleeves, Extension Stems.

(see 7-2 for sample)



1 Bills of Material
Production Clerk
2 Stock Foreman
3 Stock Clerk
4 Yard Foreman
5 Big Machine Shop
6 Big Machine Shop
7 Production File
8 Inspector
9 Pattern Shop
10 Upstairs Mach. Shop
Makes Physical Check of Inventory
Checks Stock Levels of Purchased Parts & Prepares Requisitions
Prepares Casts in Yard for Delivery To Machine Shop
Production Foreman Uses 1 copy to prepare Job Cards. Files one copy.
Schedules Machining Misc. Parts.
Checks Availability & Condition of Patterns Required
Checks Components in Final Assembly Against B/M.
Production Control Center
Production Clerk
Checks Requirements against Inventory. Indicates Shortages on B/M. Forwards To Foundry
To Foundry When Needed
Foundry Production Foreman
Schedules:
1. Patterns
2. Cores
3. Molding

Chart 7-2

President	1
Vice President, Mfg. . .	1
Sales	1
Accounting	1
Plant Manager's Clerk . .	1
Production Manager . . .	1
Production Dept. File . .	1
Pattern Shop	1
Material Foreman	1
Stock Clerk	1
Machine Shop	5
Upstairs Machine Shop . .	1
Foundry Prod. Foreman . .	1
Chip and Clean Foreman .	1
Shipping	1
	19

4" - 12" List 13A (7.3)

Production Office	1
Old Machine Shop	1
	2

Hydrant Weekly Schedules (7.4)

Production Office	1
Foundry Prod. Foreman . .	1
Material Control Foreman	1
Hydrant Shop Foreman . .	1
Old Machine Shop	1
Upstairs Machine Shop . .	1
Shipping	1

In the preparation of these schedules consideration is given to the work in process carried over from previous schedules, unfilled orders appearing in the order books not previously scheduled but which carry a promised shipping date falling within the coming calendar month, consigned stock requirements for those items shipped on consignment, and the estimated availability of materials, manpower and equipment for the coming month. Estimated daily output is based on past experience. Although standard times have been established for almost all operations

involved in the manufacture of a valve, no composite of these times for each type of valve to be manufactured during the month is used in determining monthly output.

Upon receipt of the master schedules the Material Control Foreman, the Foundry Production Foreman and the Machine Shop Production Foreman establish their detailed schedules on a weekly and daily basis.

1.4 STOCK AND STOCK STATUS

A stock file is maintained in the Production Office on all parts on hand required in the manufacture of large and miscellaneous valves, check valves and tapping sleeves. As Bills of Material are received from the Engineering Department for the large and miscellaneous valves on order, the Stock Clerk in charge of the Material Inventory Files consults these files and indicates on the Bill of Material the shortages that exist. This marked copy of the Bill of Material then goes to the Foundry Production Foreman who uses this information in conjunction with the monthly schedules to determine his weekly and daily foundry runs.

The Material Control Foreman, assisted by his stock handlers, uses a copy of the Bill of Material as a guide to pull and collect in a "tote" box all of the small parts required in the assembly of the valve. Any shortages that appear are given to the Foundry Production Foreman in order that he can include them in his foundry schedule in time to meet the assembly date established by the Machine Shop Production Foreman.

Standard valves are manufactured at the rate of approximately 2500 per month. The quantity of each individual type and size valve manufactured during the month depends upon orders on hand and an estimate

of seasonal stock requirements based on past experience. After a schedule is prepared, it goes to the Material Control Foreman who breaks the valve requirements down into components. He checks the requirements for components against stocks on hand and places a requisition with the foundry for the manufacture of these items not on hand. This requisition is broken down into weekly requirements. It might be noted at this time that the Production Foreman in the foundry schedules the work for the foundry in what he considers to be the most economical lot size; that is, it is quite possible for the Material Control Foreman to indicate a need for a specific number of items and to receive slightly more or less than he orders within a particular week. Within the month, however, he will receive a quantity equal to or slightly greater than his order.

Material requirements for check valves, air valves, iron valves below 4", floor stands and extensions and tapping sleeves are handled in the same manner as those for standard valves except for the quantity manufactured per month.

Hydrants are not manufactured as standard items. They vary in numerous details and must be tailormade to meet the requirements of each individual customer. Certain components are close enough to standard so that they can be cast in advance and held in storage as finished castings. The weekly hydrant schedule, which is based on an approximate capacity of 125 five-inch hydrants or 150 four-inch hydrants per week, is in sufficient detail so that the finished dimensions of the individual components can be determined for their manufacture. With this information the Material Control Foreman, after a physical inventory of stock on hand, notifies the Foundry Production Foreman of the requirements, and they are

incorporated into the foundry backlog.

1.5 STOCK STORAGE

The stock of parts on hand is stored in the stockroom in allocated areas but in unmarked bins and barrels in a large storage yard to the rear of the plant, and in a shed to the rear of the hydrant shop. Finished inventory is delivered immediately to the custody of the Shipping Department and is stored in the shipping area until it leaves the plant.

The parts located in the storage shed to the rear of the hydrant shop and those located in the storage yard are under the custody of the yard foreman. The foremen of the machine shops draw material from these areas as needed, and have transportation equipment assigned to them for this purpose. Material is assigned to designated storage spaces in the yard; however, in winter months, due to climatic conditions, these assignments are often ignored.

1.6 FOUNDRY SCHEDULING

The Foundry Production Foreman maintains headquarters in the Foundry Office and is primarily concerned with the scheduling and expediting of work through the foundry. As noted previously in this chapter, he prepares weekly and daily foundry runs based on the known requirements, pattern availability, manpower and equipment availability, and the scheduled shipping date of the product requiring the castings. He is allowed considerable latitude in determining the quantity of castings to be poured and the sequence in which they are poured. Since he receives a marked copy of the Bill of Material for all large and miscellaneous valves well in advance of the receipt of the monthly schedule, he can, in

order to balance work load and work force, schedule the manufacture of castings well in advance of their required date. After the weekly requirements have been determined the work load is allocated to the various work stations or sections. A summary of the work scheduled for "line" molding and the Brass Foundry is prepared weekly (7.5).

A daily production schedule is prepared for each foundry work station and isrecorded on Form M-548 (7.6) three days in advance. Copies of this schedule are distributed to the Pattern Shop, Coremakers, and the Foundry Superintendent. However, the copy for the Coremakers is delivered to the Pattern Shop and is used as a report sheet to indicate the availability of patterns. After the Pattern Shop forwards the schedule to the Coremakers via the Production Foreman all concerned are informed of pattern availability. In conjunction with the Form M-548 a Foundry Production Card (Form M-514) is prepared for work involving "floor" molding and delivered to the Pattern Shop for each pattern required. This Foundry Production Card indicates the ditto number, unit number, S.O. number, date ordered, date wanted, number of pieces and the material from which cast. The Pattern Shop attaches the card to the pattern and delivers the pattern and card to the Coremakers on the date indicated. The reverse side of the card is used by the Coremakers to record the date, number made and remarks. After completion of the run the card is returned to the Foundry Production Foreman.

The Foundry Production Schedule (Form M-548) sheet is also used to record the daily total of molds produced in the iron and brass foundries, and the number of cores made for floor molding. Copies of the daily production record are distributed to the following: Foundry Pro-

duction Office, Accounting, Plant Manager, Union Committee, Department Bulletin Board.

In scheduling work for the machine molders the Foundry Production Foreman endeavors to schedule in the most economical lot quantity. As a matter of operation practice an attempt is made to schedule work in such a manner that it becomes necessary to change equipment only once a day. This change is made at noon and, since the molders work five hours before the change and are scheduled for only three hours of work after the change, this allows the schedule some flexibility. Actually, however, the number of molds made in the afternoon depends directly on the productivity experienced in the forenoon.

In scheduling work for the floor molders and coremakers the Foundry Production Foreman bases the daily output on the standard molding and coremaking times for the molds to be poured at a daily efficiency rate of 118% of standard. The majority of parts for valves between 14" and 36" are produced by floor molding. These components are scheduled to be poured a minimum of two weeks before they are required by the machine shop. This interval at first appears excessive. It is prompted, however, by the fact that the foundry schedules are prepared for a full week and do not allow for replacing faulty castings made during the current week earlier than the following week.

Work is scheduled for the brass foundry in the same manner that it is scheduled to the machine molders. Normally no set number of items to be poured is indicated on the schedule. The Foundry Production Foreman estimates the number that will be poured based on the standard times per mold and the molders operating at 118% efficiency.

Between the "shake out" of castings and the time they reach the machine shop or a storage area it is necessary for them to go through the Cleaning and Chipping Room. Upon being cleaned a foundry delivery ticket is made showing the good castings cleaned and delivered, either to storage or to one of the machine shops. This delivery ticket is made on a Whiz billing machine and these tickets are referred to in the plant as Whiz tickets. Copies are forwarded to: Accounting, Production, and Material Control. The original goes with the material. The clerk in charge of the inventory file for large and miscellaneous valve components posts from these tickets to the stock cards maintained in that file. A similar ticket is used also to report scrap castings from the cleaning and chipping room.

The cleaning and chipping room supplies labor to the shakeout crew as well as to any other section of the foundry upon demand. This results in a fluctuating work force and at times creates a bottleneck in the flow of material through the foundry. This condition is further aggravated by the fact that the cleaning and chipping room workers are on an incentive pay system based on pounds of castings cleaned per day. This results in a tendency to clean large castings to the neglect of smaller ones. Frequently these small components can prove critical in the assembly of a large or highly important valve. In order to help alleviate this condition a daily Rush List is provided the Foundry Production Foreman by the Material Control Foreman. This list shows those items due from the foundry and needed in current machine shop operations but not yet received. It is the responsibility of the Chip and Clean Foreman to see that the cleaning of these items is expedited.

1.7 MACHINE SHOP SCHEDULING

1.71 STANDARD VALVES (4" -12" LIST 13A)

The monthly schedule of 4" - 12" list 13A valves (7.3), prepared in the Production Office, is the basis for the type and size of standard valves to be manufactured during the coming month. This schedule is divided into weekly increments. A copy of it goes to the Material Control Foreman and the other copy goes to the foreman of the Old Machine Shop. As outlined earlier, the Material Control Foreman uses his copy as a basis for determining foundry requirements for meeting the schedule. After compiling his list of requirements he confers with the foreman of the Old Machine Shop and estimates are established as to the date these castings must arrive in the Machine Shop in order to meet the assembly dates indicated in the monthly schedule.

The day-to-day scheduling of work through the Old Machine Shop (this is the shop in which all machine work on standard valves is accomplished) is performed by the foreman of that shop. The total monthly output of approximately 2500 valves is tailored to the capacity of the shop based on present work standards. There are no machine load charts employed in this shop, nor is there any Master Load Chart. Valves are either placed in inventory upon final assembly, consigned to an agent or shipped to fill a special order.

1.72 LARGE AND MISCELLANEOUS VALVES

Monthly schedules are prepared in the Production Office for all large and miscellaneous valves except hydrants and forwarded to the Big Machine Shop. A separate schedule is made for check valves, 2" - 3" valves, air valves, 4" - 12" miscellaneous valves, 14" - 48" valves,

tapping sleeves, extension [illegible] by outside contractors. No master load chart or machine load charts are maintained on the machines employed in job order manufacturing. The work scheduled is based on size and type of valves to be manufactured. The approximate average daily capacity for the Big Machine Shop is four check valves, four miscellaneous 4" - 12" valves, four 14" - 48" valves, from four to nine air valves and sixteen tapping sleeves. This daily output is based on present production standards and there are no figures available which indicate what the quality of castings received from the foundry must be in order to maintain this rate. It is assumed that any machine required on a shift or overtime basis to meet this schedule will be so employed. However, overtime must be authorized by the Vice President of Manufacturing. There is no standard schedule showing the speed and rate of feed for machine operation on the various components.

Upon the receipt of monthly production schedules from the Production Office, the Machine Shop Production Foreman breaks his work down into daily increments as shown on concentration list (7.7), coinciding as nearly as possible with the assembly dates indicated in the monthly schedules. The scheduling of work to the individual machines is accomplished by the Machine Shop Production Foreman, assisted by a Time Clerk from the Accounting Department. This is done by breaking each valve down into its components and then further breaking the components down by individual machine operations. These operations are recorded in duplicate on a Job Card which gives the set-up time for the operation, the standard time for the operation, a code number for the valve assembly to be used for accounting purposes, and certain other

information. Based on the assembly date for the valve and the standard time for each operation on the components, the Production Foreman assisted by the Time Keeper loads the various work stations daily. As an item of work is started the Job Card is marked to show the starting time for that operation and it is again marked to show the time of the completion of the operation. These cards are then forwarded to the Accounting Department to be used in computing cost and in determining the payroll. This is the only record maintained of work completed on components and it is necessary for the Production Department to contact the Accounting Department if there is any doubt as to whether a particular item has been completed. This system of scheduling makes extreme demands on both the Production Foreman and the Timekeeper; both of these men spend a considerable portion of their day engaged in personal follow-up and expediting in order to alleviate existing or potential bottle-necks.

No record is maintained by machine of down-time due to mechanical failures, nor is there any record in the Production Department as to the cost of maintenance on the various machines.

1.8 HYDRANTS

The Foreman of the Hydrant Shop works from the weekly schedule (7.4) prepared in the Production Office. This schedule usually calls for one week of production of 4" hydrants, followed by one week of production of 5" hydrants. Hydrants are manufactured at an average rate of twenty-four per day for 5" hydrants, or an average of thirty per day for 4" hydrants. When sufficient orders for hydrant repair parts are

on hand to justify setting up for their manufacture this work is sched-
uled between the manufacture of the two sizes of hydrants. No standards are employed in the Hydrant Shop other than the production standards stated in terms of units per day.

1.9 UPSTAIRS MACHINE SHOP

The Upstairs Machine Shop receives a copy of all production schedules. This shop is involved almost exclusively in the manufacture of internal brass parts and is involved to some degree in the manufacture of practically every valve and hydrant produced. The scheduling of work through this shop is accomplished by close contact between the foreman in charge of the shop and those persons interested in the receipt of the component he produces.

1-(10) PATTERN SHOP

The Pattern Shop receives copies of all schedules prepared except those for 4" - 12" List 13A valves and hydrants. As indicated earlier, the Foundry Production Foreman advises the Foreman of the Pattern Shop at least three days in advance of his need for any pattern. The monthly schedules tend to appraise the Pattern Shop Foreman of the existing workload, so that he can deploy his work force more adequately. He is provided with copies of all modified drawings in order that alterations can be made to existing patterns.

1-(11) RECORDS AND REPORTS

The Production Manager is notified of the daily production of the foundry by the Daily Production Report prepared by the Foundry Production Foreman on Form M-548; this shows the total molds produced.

He is informed of defective castings produced by the daily analysis of Foundry Scrap Report prepared by the Accounting Department. Weekly he receives from Accounting a composite Analysis of Foundry Production for the prior week broken down by foundry units in daily increments. It also shows the total pounds of metal poured during the week, and the pounds and percent of scrap produced.

A Daily Assembly and Test Report (7.8) is compiled listing by order number all valves assembled and tested each day. This is the only report received by the Production Manager which indicates the productivity of the machine shops. The Accounting Department receives and maintains on file the individual Job Cards used in loading the work stations in the Big Machine Shop. The Production Manager, by contacting the Accounting Department, can determine the status of the component parts required in the manufacture of any job in process in the Big Machine Shop.

In the Old and Upstairs Machine Shops the Shop Foremen complete a form daily (7.9) for each operator which indicates the operator's production record for the day. The work performed is designated by order number and operation. These reports go to the Accounting Department for use in determining the payroll. A study of these reports would give an indication of the shop productivity for any particular lot under consideration.

The Assistant to the Production Manager maintains a record of the inventory of finished goods on hand.

2. APPRAISAL

2.1 GENERAL

The operations involved in production scheduling and control at Rensselaer Valve Company will be compared with those principles of production scheduling and production control which are considered basic for intermittent type manufacturing by authors of texts and other authorities on these subjects.

2.2 PRODUCTION SCHEDULING

2.21 ACCURATE TIME STANDARDS MUST BE AVAILABLE FOR EACH OPERATION ON EACH PART OR ASSEMBLY TO BE SCHEDULED.

This information is available based on negotiated time standards. These time standards are conceded by both management and labor to be inaccurate in many instances. These inaccuracies in standards would result in errors in schedules based upon them. For these standards to be worthwhile for scheduling purposes a work measurement study should be conducted and accurate standards set and maintained.

2.22 PLANNING RECORDS MUST BE AVAILABLE FOR EACH PART OR ASSEMBLY TO BE SCHEDULED FOR MANUFACTURE.

The information normally contained in planning records is not available in recorded form except for set-up and standard operation times. The routing of work from one work station to the next is accomplished at the direction of the shop foreman. The present method of preparing monthly schedules does not involve the use of standard times, set-up times, transportation times or the start and finish date for the various operations. The final assembly date as indicated on the monthly schedule is the only date of any concern to the schedulers. Considerable

supervisory time is spent in directing the flow of work from one station to the next, and a considerable portion of the production foreman's time is spent in progressing work in the Big Machine Shop. This condition could be alleviated to a considerable extent if standard routing were established and realistic time standards employed.

2.23 INVENTORY RECORDS WHICH CONSTANTLY SHOW FOR ALL STORED MATERIALS, PARTS OR ASSEMBLIES, THE BALANCE OF EACH AVAILABLE FOR USE MUST ALWAYS BE MAINTAINED.

Records of this type are kept for all stock except parts required in the manufacture of 4" - 12" List 13A valves. A monthly inventory is taken of the parts required in the manufacture of the aforementioned valves. If stock records were established and maintained for these parts, the necessity for this monthly inventory would be eliminated and better inventory controls could be exercised. Once established, the present work force should be able to accomplish this work.

2.24 MATERIALS PARTS LISTS, WHICH STATE BY DRAWING NUMBER AND/OR DESCRIPTION THE UNIT QUANTITIES OF EACH PART OR ASSEMBLY REQUIRED, MUST BE AVAILABLE FOR EACH COMPLETE PRODUCT TO BE MANUFACTURED.

This information is available in the form of a bill of material provided by the Engineering Department for each non-standard item to be manufactured. In providing this information the Engineering Department employs standard reproducible forms which contain the bulk of the essential information required. These forms are modified by additions or deletions to provide all information required in the manufacture of the particular assembly. The information provided is adequate and the method employed in providing this information to those persons requiring it is economical.

2.25 SCHEDULING MUST CORRELATE QUANTITIES [illegible] TO BE PRODUCED AND DATE SUCH PRODUCTION IS NEEDED WITH AVAILABLE CAPACITIES OF PRODUCTION AND SERVICE FACILITIES.

The monthly schedules as prepared in the scheduling section do not indicate starting and completion dates for the various operations involved in manufacturing. Neither do they indicate the starting date for assembly. Using the shipping date indicated on the monthly schedule as a target, the Production Foremen in the Foundry and Machine Shop schedule their operations each week on a daily basis. These schedules partially meet the requirements of a master schedule. Since they are not compiled at the time the estimated shipping date is established, they do not assist in increasing the accuracy of this estimate. Since detailed scheduling is accomplished ultimately, it would seem advantageous if it were done prior to the establishment of a shipping date rather than afterward. If load charts or records were employed, promised shipping dates could be based on operation times and available machine and service capacities.

2.26 THE LOAD CHARTS WHICH SHOW SPECIFICALLY THE SEQUENCE OF SCHEDULED PRODUCTION AND ALL UNALLOCATED CAPACITY AVAILABLE BY WORK STATION OR LABOR GROUP MUST ALWAYS BE MAINTAINED IN THE SCHEDULING SECTION OR IN THE IMMEDIATE WORK AREA.

No machine load charts are maintained. Promised shipping dates are based on an estimate of the work on hand calculated from knowledge of the number of valves on order and the approximate manufacturing time per valve based on past experience. On the whole, fairly close approximations of shipping dates can be made in this manner; the

degree of their accuracy depending upon the experience and judgment of the individual making the estimate. When employing this method of estimating shipping dates, bottleneck conditions can arise with very little advance warning. Load Charts or Records which show the obligated time requirements against the individual work stations should be initiated and maintained.

2.27 LOAD FORECASTS WHICH SHOW EXPECTED FUTURE LOAD MUST BE MAINTAINED FOR ALL LIMITING WORK STATIONS IN THE SCHEDULING SECTION OR IN THE IMMEDIATE WORKING AREA.

The production order books indicate future work load in terms of items to be manufactured. This information is not broken down on a work station basis. Such a breakdown should prove beneficial in providing more realistic promised shipping dates, in reducing overtime requirements, and in reducing the amount of work performed by outside contractors on an emergency basis.

2.28 PRODUCTION STARTING AND COMPLETION DATES FOR EACH OPERATION ON EACH PART OR ASSEMBLY INVOLVED IN THE MANUFACTURE OF A GIVEN QUANTITY OF COMPLETE PRODUCTS MUST BE RECORDED ON A MASTER SCHEDULE BY WORK STATION.

Since detailed master schedules are not prepared, this principle is not adhered to. If the preparation of master schedules is initiated, the information called for by this principle should be included.

2.29 THE PRODUCTION STARTING DATES [illegible] INVOLVED IN THE MANUFACTURE OF A GIVEN QUANTITY [illegible] MUST BE SO SCHEDULED AS TO RESULT IN A MINIMUM IN-PROCESS INVENTORY.

This principle applies to all products manufactured but applies particularly to products manufactured on a job order basis. It is not adhered to completely at the Rensselaer Valve Company, and there is some justification for this lack of adherence. The Foundry Production Foreman endeavors to schedule foundry runs on the most economical basis. In so doing, a quantity of castings in excess of current demands might result. He must also schedule his work to where the foundry work force will be gainfully employed. This results in castings sometimes being made weeks in advance of the time they are required by the Machine Shop. The Foundry Production Foreman consults with the Production Manager when it becomes necessary to schedule work in this manner.

There are items in stock required in the manufacture of 4" - 12" List 13A valves which are in excess of current demands. This condition is recognized and efforts are being made to reduce the inventory of these items.

2.2(10) ALL PERSONNEL, WHETHER PRODUCTIVE OR NON-PRODUCTIVE, DIRECTLY INVOLVED IN THE PROGRESS OF A PRODUCTION ORDER THROUGH THE PLANT MUST ALWAYS BE INFORMED OF THE PRODUCTION SCHEDULE AND OF ANY CHANGES THERETO.

This principle applies to all manufacturing operations at Rensselaer Valve Company. The monthly schedules prepared in the Production Office and any modifications to them are distributed to all

individuals having an interest in them. Since these schedules do not contain detailed information regarding start and finish dates for the operations involved in manufacturing and assembly, they do not provide the persons who receive them with all the information required in their phase of the operations.

The schedules prepared weekly in the Foundry and Big Machine Shop contain more of the essential detailed information necessary in progressing work. Individuals concerned with progressing work are acquainted with these detailed schedules and changes made in them.

The system employed for notifying responsible persons of production schedules and changes thereto is considered adequate so long as the present production control procedures are in effect.

2.3 PRODUCTION CONTROL

One definition of Production Control is: the initiation of production in accordance with production schedules followed by the continual comparison of production performance with the pertinent standards of performance, and the continual adjustment of production performance in an effort to conform to the specified standards.

2.31 ALL FORMS USED TO DISTRIBUTE, TO PERTINENT PERSONNEL, INFORMATION AS TO SCHEDULED STARTING AND COMPLETION DATES, AND AS TO ACTUAL PERFORMANCE, MUST BE PRODUCED BY THE MOST ECONOMICAL AND SATISFACTORY METHOD.

This principle is adhered to closely. The only noticeable exception being the job cards used to assign work to the various work stations in the Big Machine Shop, which are filled in by hand. A

considerable portion of the information that has to be put on each of these cards is repetitive and could be printed on them by the printer manufacturing the cards or filled in with addressograph plates by the Company. This condition is recognized by the Company and steps are being taken to correct it.

2.32 ALL PRODUCTION CONTROL RECORDS MUST BE SYSTEMATICALLY DISPATCHED AND ROUTED BETWEEN THE PRODUCTION CONTROL CENTER AND THE VARIOUS PERSONNEL INVOLVED IN THE PROGRESS OF A MANUFACTURING ORDER SO THAT ANY GIVEN MOVEMENT OF EACH SUCH CONTROL RECORD ALWAYS CAUSES THE SAME ACTION TO TAKE PLACE AUTOMATICALLY.

No Production Records other than the monthly schedules are prepared in the Production Control Center. These records as well as records initiated in any other department which have a production shop as their destination are dispatched from the control center in accordance with a set routine. They are acted upon automatically when received by the persons responsible for taking action.

2.33 PRODUCTION CONTROL RECORDS SHOULD BE REDUCED TO A MINIMUM NUMBER BUT SHOULD BE SUFFICIENT AND PRODUCED EARLY ENOUGH IN THE MANUFACTURING CYCLE TO FOLLOW PROPERLY THE PROGRESS OF MANUFACTURING ORDERS THROUGH THE OFFICE AND FACTORY WITHOUT THE NEED OF SUBSEQUENT RANDOM WRITTEN REPORTS AND RECORDS. SUCH CONTROL RECORDS NORMALLY INCLUDE THE FOLLOWING:

a) Manufacturing release
b) Materials move order
c) Materials identification tag
d) Job Card for each manufacturing operation
e) Progress notification
f) Inspection records

[illegible]

Company. [illegible]

these records [illegible]

[illegible]

lease. The Production [illegible] the Shop Foreman in the [illegible] shop [illegible] work and [illegible] on these [illegible] satisfactory.

No system is employed which [illegible] material [illegible]. The flow of material is controlled by the [illegible] ment in performing this function.

No material [illegible] of such tags [illegible] particular component [illegible] components into the final assembly.

Job Cards are provided for each [illegible] in the Big Machine Shop. They are not used elsewhere in the plant nor are they considered necessary.

Drawing print requisitions are not used since a file of commonly used prints is maintained by the shop foremen. The [illegible] correct print is provided the machine operator by the foreman when required.

No progress notification is employed. A file of completed job cards is maintained in the Accounting Department. [illegible]

vidual can check the status of a particular job by contacting the Accounting Department.

The routine inspection records consist of a Daily Test and Assembly Report and a Daily Scrap Report. Special inspection reports are maintained on orders for customers requiring inspection certificates. These records do not provide the Production Control Center with the information considered essential for purposes of production control, as they do not indicate the work station responsible for defective production.

No finished component receipts are employed. The various foremen involved in the final stage of manufacture of components schedule their output to conform with the requirements established by the weekly schedules. There is no reporting system which will automatically notify the Production Control Center if any component required in an assembly falls behind schedule. If such a reporting system were installed much of the personal follow-up presently being done by the Production control Foremen in the Big Machine Shop would be eliminated.

No summary master schedules are maintained. Such schedules could be prepared easily from the master schedules if such were maintained.

2.34 ALL PERTINENT DATA, MATERIALS AND EQUIPMENT REQUIRED FOR THE MANUFACTURE OF A GIVEN PART OR ASSEMBLY MUST BE READILY AVAILABLE BEFORE AN ORDER FOR ITS MANUFACTURE IS ISSUED. PERTINENT DATA, MATERIAL AND EQUIPMENT WOULD NORMALLY INCLUDE:

a) Operation Standard Methods
b) Operation Standard Times and Wage Rates
c) Work Station Routing
d) All Tools, Gauges and Fixtures Required
e) All Material Required
f) Drawing Print and/or Manufacturing Specifications
g) List of Parts or Materials to be Assembled or Combined during Manufacture.

To a certain extent standard operating methods are employed. They have not been reduced to writing, however. The other elements involved in this principle as enumerated above are at the start of manufacturing operations.

2.35 MANUFACTURING ORDERS ISSUED TO PRODUCTION DEPARTMENTS MUST BE FILED SYSTEMATICALLY ADJACENT TO THE WORKING AREA, BY WORK STATION, AND THEREUNDER BY STARTING DATE, IN SUCH A MANNER AS TO REFLECT THE INFORMATION (WITH RESPECT TO EACH WORK STATION) RECORDED ON THE LOAD CHARTS IN THE SCHEDULING SECTION. THEY MUST BE RELEASED FOR ACTUAL MANUFACTURE IN CHRONOLOGICAL ORDER OF STARTING DATES AND MUST BE ARRANGED TO SHOW CLEARLY FOR EACH WORK STATION AT ALL TIMES:

a) Work due to be completed at any date
b) Standard hours of work in process
c) Current days load yet to be processed
d) Standard hours of work ahead for any day or week
e) Standard hours of work overdue

The information called for in the statement of this principle is available and is used in the Big Machine Shop. There being no load charts or records employed in the Production Center, the records maintained for each work station are not closely associated with the monthly schedules.

2.36 ACTUAL PERFORMANCE AS TO QUALITY, QUANTITY AND TIME FOR EACH WORK STATION OR LABOR GROUP MUST BE KNOWN AT ALL TIMES AND RECORDS THEREOF MUST BE MAINTAINED SYSTEMATICALLY ADJACENT TO THE IMMEDIATE WORKING AREA.

This principle is complied with as to quantity and time for the actual performance of each work station and labor group. There are no records maintained which relate to the quality of work performed at each station. Such information would be of value in appraising the performance of individual workers, in maintaining quality standards, and in providing additional knowledge to be used in preparing work schedules.

2.37 RECORDS OF ACTUAL PERFORMANCE AS TO QUALITY, QUANTITY AND TIME FOR EACH OPERATION ON EACH MANUFACTURING ORDER MUST BE APPRIASED AND PROMPTLY REPORTED TO THE PRODUCTION CONTROL AND ACCOUNTING CENTERS, IDENTIFIED AS TO OPERATOR AND WORK STATION OR LABOR GROUP BY WHICH THE OPERATION WAS PERFORMED; MUST BE APPRAISED AND REPORTED SYSTEMATICALLY BY CONTROL PERSONNEL NOT UNDER THE JURISDICTION OF THE EXECUTIVES IMMEDIATELY RESPONSIBLE FOR PRODUCTION EFFICIENCY; AND MUST BE ATTAINED IN MINIMUM TIME AT MINIMUM COST.

The mechanics required in the observation of this principle are presently installed throughout the manufacturing areas except as they relate to quality of production. This machinery is not utilized to its fullest extent, however.

Daily reports are made in the Foundry and in the Machine Shops which indicate that day's productivity by work station. This information is provided in terms of units produced and in terms of percentage of standard production. These reports are forwarded to the Accounting Department without appraisal. They receive wide distribution; the Production Manager does not receive a copy of them, however.

This principle can be complied with readily without any appreciable added expense or effort. Such records would provide a source of information for use in preparing production schedules as well as well as in apprising constantly a wider segment of management of right or loose standards; b) would indicate productive and non-productive workers; c) would give an indication as to where scrap is occuring, so that corrective action might be initiated; and d) would give timely notice to Production Control personnel of deficiencies in order that prompt remedial action might be taken.

2.38 ACTUAL PERFORMANCE AS TO QUANTITY AND TIME FOR EACH OPERATION ON EACH COMPONENT, SUBASSEMBLY OR ASSEMBLY BEING MANUFACTURED MUST BE RECORDED SYSTEMATICALLY AND PROMPTLY ON THE MASTER [illegible] COMPLEMENTARY OPERATIONS SCHEDULE ADJACENT TO THE [illegible] FOR THE SAME OPERATION, IN SUCH A MANNER AS TO [illegible] VARIATIONS BETWEEN ACTUAL PERFORMANCE AND SCHEDULED PERFORMANCE.

No Master Schedule or Operations Schedules are maintained; therefore this principle is not complied with. If Master Schedules, as discussed in Paragraph 2.25, are initiated, this principle should be adopted.

2.39 SIGNIFICANT VARIATIONS BETWEEN SCHEDULED PERFORMANCE AND ACTUAL PERFORMANCE AS TO QUALITY, QUANTITY OR PROGRESS MUST BE REPORTED SYSTEMATICALLY AND PROMPTLY TO PERTINENT CONTROL PERSONNEL.

The comments relating to the preceding principle also apply to this one.

2.3(10) CONTROL PERSONNEL MUST ACT EFFECTIVELY AND PROMPTLY TO ELIMINATE THE CAUSES AND/OR THE EFFECTS OF SIGNIFICANT VARIATIONS BE-

TWEEN ACTUAL PERFORMANCE AND STANDARD OR SCHEDULE ... AS TO QUALITY, QUANTITY AND TIME OF COMPLETION. SUCH CONTROL ACTION MAY ENTIAL:

a) DETERMINING AND SEEKING TO ELIMINATE THE CAUSES OF SPOILED OR REJECTED WORK SUCH AS DEFECTIVE MATERIALS, TOOLS, MACHINES AND EQUIPMENT OR POOR WORKMANSHIP.

b) SEEKING TO ELIMINATE THE EFFECTS OF SPOILED OR REJECTED WORK BY INITIATING REMEDIAL WORK OR BY ORDERING AND EXPEDITING REPLACEMENT COMPONENTS.

c) DETERMINING AND SEEKING TO ELIMINATE THE CAUSES OF DELAYS SUCH AS LATE DELIVERY OF MATERIALS, TOOLS, DRAWINGS AND DATA; DEFECTIVE MATERIALS, TOOLS, MACHINES AND EQUIPMENT; TIGHT OR LOOSE RATE ... ; OR ... DISSATISFIED OPERATORS.

d) SEEKING TO ELIMINATE THE EFFECTS OF DELAYS ... EXPEDITING ACTIONS SUCH AS REROUTING WORK TO OTHER FACILITIES HAVING AVAILABLE CAPACITY (... INCREASING COSTS), OVERTIME WORK, OR EXTRA SHIFTS.

This principle is adhered to as closely as can reasonably be expected in an industrial situation where load charts and master schedules are not employed.

The Production Control Foremen act promptly to notify the Production Manager of defective critical components in order that repairs or replacements might be initiated. This situation could be improved possibly if such information were provided by a routine reporting procedure wherever possible. Under the present method of making only verbal reports to the Production Manager a need for repairing or re-

placing a critical item might escape his notice.

The Production Manager seeks to eliminate causes for delays resulting from late delivery of materials or data. He is powerless to eliminate delays caused by improper time standards, absenteeism, delinquent or dissatisfied operators.

Action is initiated by the Production Manager to "farm out" work to contractors having available capacity to meet the scheduled shipping dates whenever it becomes apparent that plant facilities are overloaded. He recommends overtime or shift work when, in his opinion, it is necessary.

A firmer basis on which the Production Manager could base his decisions would be available if master schedules and load charts were employed.

3. RECOMMENDATIONS

3.1 GENERAL

In keeping with the recommendations contained in Chapter IV that the manufacture of 4" - 8" List 13A valves be accomplished on a product controlled or production line basis, and that 10" and 12" List 13A valves be manufactured on a modified product controlled basis, the recommendations made here will pertain to the scheduling and production controls involved in manufacturing large and miscellaneous valves other than hydrants. It is believed that the present manner in which hydrants are scheduled and the production controls exercised are satisfactory.

In scheduling 4" - 12" List 13A valves under the proposed manufacturing process it will be necessary to determine the bottleneck operation involved in their manufacture and schedule all other operations accordingly. Control is exercised by comparing the daily output of finished products with the daily input of components.

Whereas the below listed recommendations are concerned primarily with products manufactured on an intermittent basis, certain of them apply equally to all manufacturing processes.

3.2 SPECIFIC

a) Establish accurate time standards and methods including set-up times for each operation involved in the manufacture and assembly of all products manufactured by the Company. Standard methods should be reduced to writing and made known to all operating personnel.

b) Establish reasonable time allowances for the accomplishment of transportation between each work station.

c) Continue to collect data relating to individual worker productivity as done at present and provide such data to production control personnel.

d) Maintain and provide production control personnel with records of the quality of product produced (percent scrap) by individual work station.

e) Prepare and maintain currently a load record which will show the capacity of each work station, the hours of work obligated against this capacity and the unobligated capacity available for additional work.

f) Establish planning records for each major component, for lots of all small components, and each subassembly and assembly involved in the manufacture of each product.

g) Establish a perpetual inventory of each item of stock on hand (this term, "stock", includes all parts, castings, materials and supplies used in conducting business operations) and minimum and maximum stock levels for each item. These levelsshould be determined from a study of past usage data, the time required for replenishment, the size of the most economical lot and the weighted average money value of the inventory.

h) After the implementation of the foregoing recommendations, prepare master schedules in the Production Control Center. These schedules should be prepared in detail for each order for large and miscellaneous valves. They should show the start and completion date for each operation, subassembly and assembly involved in the manufacturing process.

In order to keep set-ups to a minimum and to be able to schedule in such a manner that the most favorable shipping rates can be real-

ized, schedules should not be prepared more often than once a week. A customer should not be informed of an estimated shipping date until his order has been scheduled if this plan is to function at maximum effectiveness. It is recognized that this goal cannot always be attained but every effort should be exerted to reach it.

A master schedule (prepared in the form of T-1) will, upon release, indicate automatically all action required, the work centers in which the action will take place with its starting and completion dates. It will be noted that the Pattern Shop and Foundry are included on this schedule for only work involving the cover, case, and gates. The remaining parts required in the assembly will be scheduled periodically for foundry manufacture on a lot basis. These items will be carried in stock and will be issued to the Machine Shop prior to the scheduled starting date for machine operations on the particular item.

i) Combination move and identification tags should be used in routing components through the Machine Shop and Assembly areas. These tags should be made up of detachable stubs and affixed by a dispatcher in the Machine Shop. Each stub of the set will show the S. O. number, the size valve and a work station number. The bottom stub will list the number of the first work station and the other stubs will follow in the same sequence as shown on the master schedule. When the work specified to be performed at the first work station has been completed, the operator or timekeeperwill remove the stub listing the number of that work station, and the bottom stub remaining then will indicate the number of the work station to which the part is to be moved. The stub will be returned to

SIZE 14"	LIST 13A	DESCRIPTION NRS Flg End Valve							S.O. Y00386 Code 1-5-6	
OPERATION	Machine No.	Set up Time	Standard hrs/pc.	START Date/time	FINISH Date/time	REVISION #1 Start Date/time	REVISION #1 Finish Date/time	ACTUAL Start Date/time	ACTUAL Finish Date/time	
PATTERN SHOP Prepare patterns & deliver to foundry				01/0800	03/1530					
FOUNDRY Make core & bake				04/0700	04/1530					
Make mold & pour				05/0700	05/1530					
Knock-out, chip & clean				08/0700	08/1530					
STOREROOM Deliver Misc. parts to Machine Shop				05/0800	05/1530					
MACHINE SHOP Machine Misc. parts	15			08/0700	09/1530					
CASE Ring & face end	127-~~148~~	:24	2:53	09/1200	09/1530					
Drill Nk End flg }	139-~~53a~~	:24	1:42	10/0700	10/0915					
Drill & Tap Plug }	139-~~53a~~									
Face Nk Flg	154	:24	:20	10/0930	10/1020					
GATES (2) Drill, Tap for pegs & inclines	53a	:10	:21	09/1200	09/1235					
Face off ring	127-~~148~~	:24	:36	10/0700	10/0805					
COVER Face, bore, bush top	~~127~~-148	:24	:34	09/1200	09/1300					
Face Neck Flange	~~127~~-148	:24	:34	09/1300	09/1400					
Drill Neck Flange	~~139~~-53a	:06	:25	09/1415	09/1450					
ASSEMBLE - Test, prepare for shipment			2:38	10/1030	10/1340					

Fig 7-1

the dispatcher who will use it to indicate the [illegible] the master schedule he maintains. In this manner he is informed con-stantly of the status of all work in progress in the shop and can notify the Production Control Center immediately of any significant variance.

3.3 SUMMARY

It is believed that the foregoing recommendations can be implemented with the present work force now employed in performing production scheduling and control duties. In present practice a goodly portion of the detailed scheduling recommended for performance in the Production Control Center is being done, but not at the proper time or in the proper place. Production control personnel are spending a considerable portion of their time in follow-up work which, it is believed, will no longer be necessary if the recommended changes are effected. The timekeeper, who at present assists the Production Foreman in the Big Machine Shop, could perform his present duties as timekeeper and the added duty of dispatcher for the machine shop, since a large portion of the work he now does will be removed from that area. The Production Foremen in both the Foundry and Machine Shop could move into the Production Control Center to assist in the preparation and maintenance of load charts, planning records and master schedules. In addition they would be available to evaluate statistical data and to progress work showing a significant variance from standard.

The principle advantages to be realized from the recommended revisions to thepresent production scheduling and control methods would be:

a) Reduced in-process inventory
b) Reduction in in-process storage requirements

c) Accelerated rate of turnover of working capital
d) Reduction in working capital required
e) An increase in customer goodwill due to improvement in meeting shipping dates.

For this sytem to be fully effective, clear and concise, position descriptions should be prepared and published for all positions required in production scheduling and control operations. These position descriptions should state clearly the field of operations in which the position incumbents will be engaged, their authority and responsibilities and their relationships with superiors and subordinates. The responsibility and authority delegated to the incumbents must be respected by their superiors as well as by their subordinates.

CHAPTER VIII

PURCHASING AND TRAFFIC

1. FINDINGS

As seen on the organization chart (1.1), this department is under the direction of the Purchasing Agent and Traffic Manager who reports to the Vice President of Manufacturing. The Department consists of the Purchasing Agent, Assistant Purchasing Agent, Receiving Clerk, Shipping Clerk, three File Clerks and a Secretary. Figure VIII-1 shows the flow of forms used by sections of this department. The Department can be described most conveniently by analyzing each major function separately.

1.1 PURCHASING

The Purchasing Section performs its job with the minimum of paperwork and employees. The Purchasing Agent keeps himself and those responsible for the purchasing functions informed of major trends in prices. To accomplish this he is a member of the Purchasing Agents Association. The Department receives necessary purchasing literature. Contacts are maintained with all suppliers and wherever possible the supplier with the low bid and satisfactory delivery is given the order. There was no indication of favorites being given preferred business; and it is a rule to see all salesmen.

Foundry and manufacturing costs are checked continually by the Purchasing Agent. Where it is possible to purchase castings or other manufactured items at a lower cost than they can be produced by the Rensselaer foundry or machine shop, bids are obtained from these outside

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

FLOW OF REQUISITION, PURCHASE ORDER & RECEIVING TICKET.

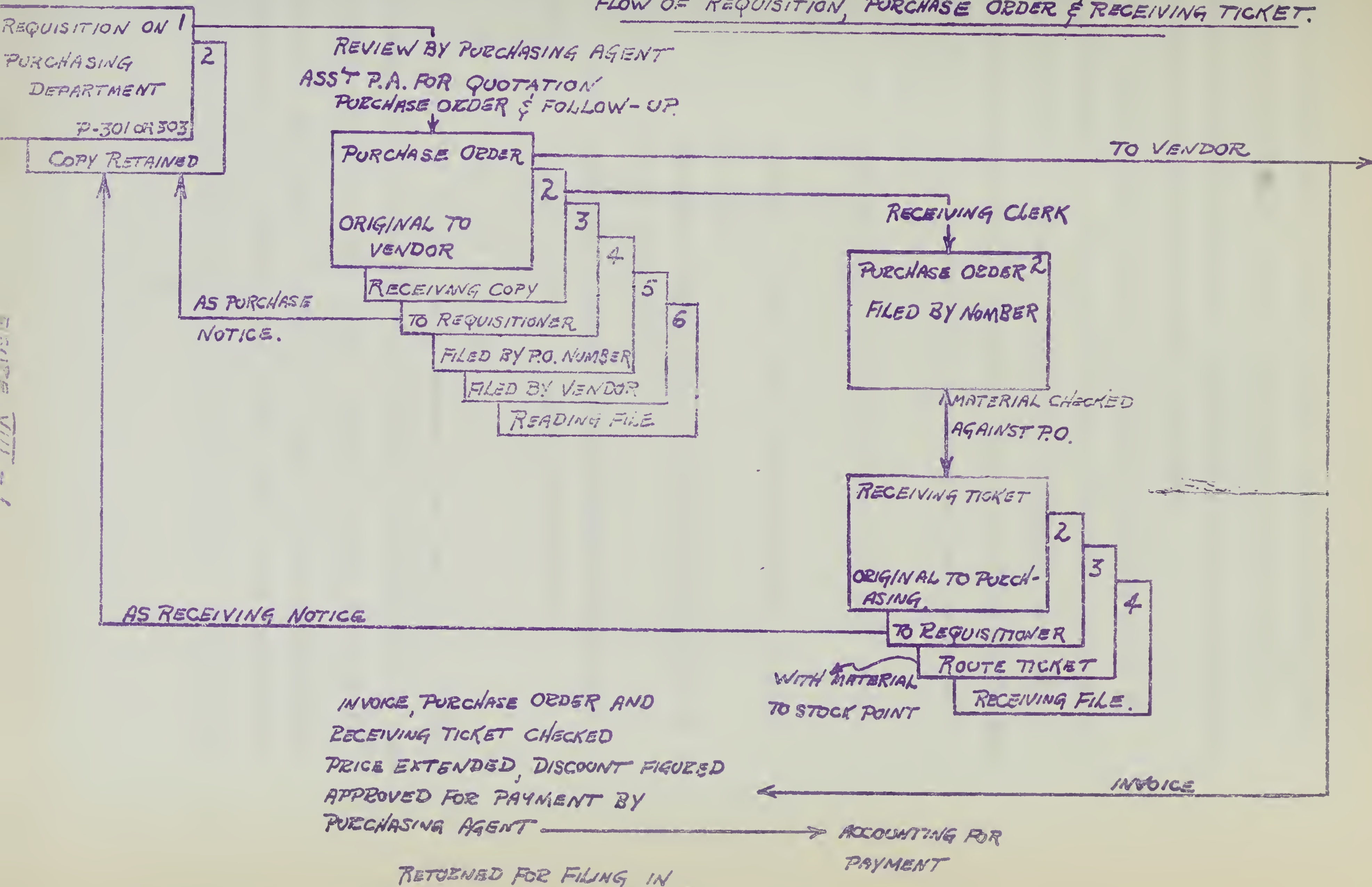


FIGURE VIII-1

sources. In many cases purchases are made. The best example of such a situation is large valve bodies. It was found that these could be purchased from other foundries at a substantially lower cost than those produced by the floor methods used at Rensselaer.

No method was observed for measuring the efficiency of the Purchasing Section. A daily record is kept on the total dollar value of commitments made by Purchasing. While these figures are the basis of the Purchase Section's daily expenditure report, no further use was made of the data. Average costs of obtaining quotations and placing orders were not available.

The purchasing system can be broken down into three broad classes:

(i) Purchases of raw materials for manufacturing. That is, pig iron, scrap and coke.

(ii) Purchases of small items of stock and supplies such as nuts, bolts, paint and other supplies.

(iii) Purchases of finished or semi-finished goods such as castings, small valves, equipment, machinery and patterns.

1.2 PURCHASES OF RAW MATERIALS

Since the largest item of expense in the operation of a foundry is the raw materials which are fed the cupola, the Purchasing Agent pays particular attention to these items. The price of these raw materials, particularly scrap steel, is subject to sudden and drastic fluctuations in market value and availability of desired grades. Thus, although the use of these items can be estimated with a high degree of accuracy, the

[illegible]

most economical quantity to order and inventory to have on hand is subject to wide variance. The Purchasing Agent must be able to interpret the market trends in order to insure that sufficient quantities are on hand at all times while safeguarding against having a large inventory with a falling market.

Orders are placed to insure at least one month's supply on hand at all times. Should the price seem low at a given time, an amount equal to four or five months' supply may be bought. Since this decision is in actuality speculation with Company funds on the commodity market and not the function of the Purchasing Section, it is not taken lightly. Should heavy purchasing appear profitable, the Purchasing Agent consults with the Vice President of Manufacturing and the President before placing an order.

A perpetual inventory (8.1) is maintained on iron scrap, steel scrap, pig iron, coke, foundry returns and similar items for the brass foundry. The totals are adjusted daily by the Secretary to the Purchasing Agent. These adjustments are obtained from the foundry's Daily Raw Material Report. When the level of the inventory reaches a low point (one month's supply), an order is made. The figures are computed by averaging past monthly charging reports. From these records the Purchasing Agent also can tell immediately if he should take advantage of some special offer on scrap from some reliable source if such offer is tendered. The Purchasing Agent can call to the attention of the Vice President of Manufacturing and the Foundry Foreman any out-of-line usage of any of these commodities from reviewing these records.

1.3 SMALL STOCK ITEMS

Inventory control and purchases of stock material for production is maintained by the Production Stock Clerk using three forms: the Production Material Requisition (8.2), the Stock Record (8.3), and the Requisition on Stock Room (8.4).

There is prepared for each item used repeatedly in production both the Production Material Requisition and a Stock Record. The Stock Record is used to post usage of material, and the Production Material Requisition to reorder material.

When the Requisition on Stock Room, prepared by the person obtaining material from the stock room, reaches the Production Stock Clerk, he records the use of material on the Stock Record card. This card carries a minimum balance. When the amount shown on the stock card reaches this point, the Production Stock Clerk removes the Production Material Requisition from the file. On this form he records the quantity needed and the delivery required. He forwards the card to the Production Manager for approval of purchase. The requisition is then sent to the Purchasing Section.

The Assistant Purchasing Agent upon receipt of this requisition places a Purchase Order. He then records the vendor, the purchase order number and the promised delivery date on the form and returns it to the Production Stock Clerk. When the material is received, the Stock Clerk is informed of its delivery by the second copy of the receiving ticket. He then posts it on both the Production Material Requisition and the Stock Record card.

The Purchasing Agent periodically reviews the maximum and

minimum balances and the reorder quantity to insure that they are consistent with availability of material, trade discounts and any anticipated price changes.

1.4 PURCHASES OF FINISHED OR SEMI-FINISHED GOODS FOR PRODUCTION

These orders originate in the Production Scheduling Section. Upon receipt of a bill of material from engineering or a manufacturing order for standard valves, the Production Stock Clerk checks the stock record cards to determine the status of stock. If the piece requires reorder, a requisition on Purchasing Department (8.5) is prepared. This form is approved by the Production Manager and then sent to Purchasing. All such orders are reviewed by the Purchasing Agent before a purchase order is written. The same form is prepared for all outside purchases of miscellaneous items required for the production departments, such as patterns, machine tools and castings of large sizes not produced in the foundry.

The Purchasing Section maintains follow-up files on all purchase orders. All orders are filed after being filled, and all pertinent papers are kept with the order until they are considered no longer necessary.

1.5 TRAFFIC

The Traffic Section is made up of three branches: the Office and File Branch, the Receiving Branch and the Shipping Branch.

The Office Branch consists of the Traffic Manager, who is also the Purchasing Agent, and a file clerk. All records and freight bills

[illegible]

are maintained in the office. The Traffic Manager approves payment of all freight bills and makes policy decisions for the Traffic Section.

1.6 RECEIVING

The Receiving Clerk is the only man in the Receiving Branch. Additional manpower, if required, is furnished by the foreman of the yard gang.

The Receiving Clerk acts as a coordinating activity for incoming freight. As seen of Figure VIII-1, the Clerk is furnished the second copy of all Purchasing Orders. These he files numerically until receipt of the material. Upon receipt of material he makes a visual inspection. The receiving ticket is prepared then in quadruplicate and distributed.

Since no large amounts of materials, other than raw material for the foundry, are purchased, no formal inspection service other than cursory inspection is considered necessary. The clerk relies heavily upon the past record of the vendor in making his inspection. If the vendor has proved reliable, he usually accepts the shipment as stated, checking only on weight or physical count. The formal inspection then is done on the production floor or storeroom. On those vendors with a poor past history the Receiving Clerk calls the Inspector upon receipt of the goods. The Inspector then checks the shipment thoroughly and accepts or rejects as necessary.

Raw material for the foundries such as pig iron and scrap is treated in this manner also. The Purchasing Section has a policy of dealing with only reliable sources of supply. Thus incoming shipments are checked by the Receiving Clerk for weight only. He usually accepts

the weight master's ticket as proof of correct shipment. Complaints from the foundry for poor or off-grade materials are made directly to the Purchasing Agent.

The receiving ticket in use works very well. The Receiving Clerk maintains a record of all urgently required materials. This record is either picked up from the Purchase Order or by verbal request of the requisitioner. Upon receipt of the material the user is notified and he may pick up the material immediately. The user need only sign the third copy of the ticket which then is sent to the storeroom for recording.

The Receiving Clerk's file of receiving tickets serves as a quick reference as to what was received in a shipment. It serves also as a cross check for auditing of purchase order invoices. The auditor can check the receiving ticket to see if the material paid for on the invoice is the same as the material received.

1.7 SHIPPING

The Shipping Clerk is responsible for tagging each piece of an order with a tag showing the customer and customer's order number. He orders the truck or cars for shipping. The physical loading of the material on the carrier is the responsibility of the foreman of the yard gang. It is done under the indirect supervision of the ShippingClerk. The Clerk prepares the necessary bill of lading, obtains the proper signatures and sees that the load is aboard the proper carrier.

After a shipment is made the second copy of the bill of lading is sent to the Traffic Section for review and filing. The third copy, along with the Shipping Clerk's copy of the Sales Order, is routed to the Production Scheduling Section which records the shipment in the

[illegible]

[illegible]

[illegible]

schedule and destroys its copy of the order. Production Scheduling forwards these papers to the Accounting Department where, using these as proof of shipment, the invoice is prepared.

At the end of each day the Shipping Clerk prepares the Daily Shipping Report (8.6). This form is a summary of the orders shipped for the day. The original is sent to the Traffic Section for filing. Copies are made for the President and the Vice President of Manufacturing.

The shipping itself is routine and follows standard practice. All methods of transportation are used and the present services are satisfactory.

While the physical shipping is routine, the scheduling of orders for shipment needs constant checking. This is due to the high rates charged for small lot or partial shipments. Since freight charges for the past year averaged six percent of gross sales, it readily can be seen that this section offers a potential field for economizing.

The Shipping Clerk uses the Daily Assembly and Test Report, the Monthly Production Schedule and an oral report from the Foreman, Hydrant Department, to make up his loads. Should the load to any one point make up a car or truck lot, it can be shipped immediately. Should the completed material be less than car or truck load lot, further reference is made to the Monthly Production Schedule, and the Production Manager is consulted to determine whether the shipment can be held until additional material for the same destination is completed. The additionalweight required to obtain the lower freight rates is then scheduled for the following day if possible. If a longer delay or substitution of similar products from other orders is necessary to

arrange these shipments, the Sales Department is consulted on the effect on customer relations. The shipment of valves for consigned stock also is used extensively to alleviate this situation, and thus obtain low rates for this material.

If it is impossible to make a truck or carload shipment without a long delay or because of lack of storage space, a less than carload lot is shipped. These shipments cost as much as twice the carload rates and in many cases seem beyond the control of the Shipping Clerk.

There was observed no fixed methods for loading large valves aboard flat cars or for securing the valves after being loaded. No plans or standard instructions for loading or bracing are available. Cost records are not kept for the material or labor required for this work. It was reported that large amounts of lumber are purchased for shoring and bracing, but few records are maintained on its utilization. It was stated that very little damage is sustained to the products during shipment and that in the few cases reported the carrier was at fault.

2. APPRAISAL

The operation of the Purchasing and Traffic Department is satisfactory. The Purchasing Agent and Traffic Manager is well informed on all matters pertaining to his Department. It is commendable that the overall impression gained upon observing the operation is that the lowering of purchasing costs, the increasing of quality of goods purchased and service to the Production Departments are the aims of every member of the Department.

There are a few areas where comments need to be made. As stated in the FINDINGS, no means for measuring the Purchasing Section's efficiency were observed. It is as true in the service sections such as Purchasing and Shipping as it is in the Production Departments that to obtain the best from any worker an incentive must be present. One such method of obtaining the incentive in service departments is an efficiency rating. This rating can be compared month by month and year by year. The Department can have a goal at which to aim.

Purchasing efficiency can be rated in terms of a ratio dollar value of purchases to number of orders. If desired, the cost to write a purchase order, along with savings realized from good purchasing practices, reduction in inventories and reduction in departmental expenses also can be used to compute this rating. There are several methods known to develop such a system. Where such systems are used an improvement in the department is noted.

The shipping function, a known expense amounting to six percent of gross sales in freight charges alone, offers a field of investigation where potential savings can be made. While the proper methods

of transportation and up-to-date freight rate and routing books apparently are being used, the possibility of a reduction in rates by the use of a special freight service should be considered.

A further refinement of the production schedule should be accomplished so that valves can be completed in lots which made up car-load shipments to a single destination. This could reduce expenses by taking advantage of the lower rates.

It is felt that unnecessary labor and materials are used many times to prepare large valves for shipment. The lack of standard loading plans and instructions are felt to be the reason for the high expense of this operation.

3. RECOMMENDATIONS

(i) A system of rating the efficiency of the Purchasing and Traffic Department be installed in order that the month-to-month and year-to-year progress of department sections can be ascertained. Such a system should lead to an improvement in the operation of the sections and quickly point out to the Purchasing Agent and Traffic Manager when a deviation from standard occurs.

(ii) A further refining of the scheduling procedure be made so that valves sold at relatively the same time for the same destination be scheduled for completion on the same date; thus, shipments could be combined to obtain the lowest possible freight rates.

(iii) A set of standard loading plans be made showing recommended loading for all valves over 24" diameter, and that shipping instructions be prepared for the loading of all valves.

CHAPTER [illegible]

INSPECTION AND QUALITY CONTROL

1. FINDINGS

1.1 PRESENT INSPECTION ORGANIZATION, PROCEDURES AND RECORDS MAINTAINED.

The inspection organization consists of the Chief Inspector and the Assistant Inspector. The Chief Inspector can report on product quality and process conditions directly to the President. He attempts to maintain quality of product primarily seeking the voluntary co-operation of all personnel (engaged in foundry, machine and assembly operations and elsewhere in the organization) in paying attention to quality at all times. The Chief Inspector works with everyone in the organization who contributes to manufacture of finished product. He brings to the attention of cognizant [illegible] defects in product and marks defective product where possible. He makes decisions as to what is scrap and what is not scrap. In the event the cognizant supervisor will not accept a decision of the Chief Inspector concerning scrap material, the decision can be appealed through the supervisory chain to the Vice President of Manufacturing. Based on other considerations, such as customer acceptance of a slight deviation from engineering drawings, the inspector may change his standard of acceptance. However, in no case is shipment made of a known defective product, from the viewpoint of safety considerations. Nearly all product in final assembly is given a hydrostatic test which subjects the valves and hydrants to twice the designed service pressure. In the past few years, however, some

customers have subjected valves to constant working pressures somewhat higher than the service pressure for which the valve originally was designed. For example in the case of the Series 11 valves which are designed for 35 psi. working pressure and tested at twice this pressure, certain customers are using these valves at 50 psi. or higher. Even though the sales order in such a case states that the valve is to be used at a constant higher pressure, the valve is tested in final assembly inspection to twice designed service pressure and not to twice customer designated service pressure. The acceptance of such sales orders by the Company makes subsequent inspection acceptance less conclusive since the probability of accepting and shipping only good valves is reduced. In other words practically all the accepted valves would be good 35 psi. valves but some of the same accepted valves might not be good 50 psi. valves even though all valves were tested at 70 psi.

The working time and effort of the two inspectors are concentrated in non-destructive inspection of castings, machined castings and assemblies, at various stages of manufacture. Visual inspection of castings and machined castings comprises about 75% of the time of the inspectors. This includes segregation of the scrap from the apparently good product starting at "shakeout" and continuing through all subsequent operations such as casting cleaning, machining, assembly and test. In inspecting machine parts it is not customary to check dimensions of machined surfaces, primarily due to the fact that very few tolerances are shown on component drawings. Micrometer calipers are available but are seldom used. Most of the remaining time of the inspectors is given to final assembly inspection which includes principally checking of

dimensions of castings against engineering drawings. During assembly of large valves the inspectors are present to check the fit of operating parts and to insure that clearances are in accordance with drawings and past experience of the inspectors. This function cannot be precise because of the lack of dimensional tolerances on drawings.

The Chief Inspector attempts to decrease the percentage of scrap at the source, the foundry. His recommendations are made to the Foundry Superintendent and concern all phases of foundry operations. He tells the foundry personnel the probable causes of scrap, such as shrinks, porosity, drops, etc., and suggests reasons for defectives being produced. These reasons usually are obvious to the Foundry Superintendent. Due to the heavy pressure of supervising the operating iron and brass foundry work, however, the Foundry Superintendent is able to devote to the control functions necessary for consistent high quality only that attention necessary to maintain the required production output of approximately 90 to 95% good castings.

A scrap rate which varied from 5 to 10% (average 9%) was experienced last year. Effort is being made to bring it down to 5% this year. Top management and the Foundry Superintendent are concerned over the scrap rate and are reducing it. The scrap problem is essentially a problem of top management.

The Chief Inspector and the Assistant Inspector are not able to do more than perform purely inspection functions. The standards for quality product are not their responsibility nor are the standards for production processes theirs. The Chief Inspector has the authority to shut down the foundry and any other segment of manufacturing but must

inform top management when he does and give reasons for so doing. He does find reject rates up to as high as 50% on certain products at certain times. In order to maintain a seemingly high production rate no real effort is made by management to insist on exact standards of personnel performance nor to provide incentive pay for correct performance for each foundry operation involved, such as the molding and pouring operations.

The only written report made by the Chief Inspector is an Inspection Report which is required by the Los Angeles Sales Office. This is an inspection requirement of the City of Los Angeles. The Inspection Report (9-1) on every valve and every other item for Los Angeles is completed by the Chief Inspector. The President and Vice President of Manufacturing receive the original of this report. The copy is filed in the Inspection Office. A Certificate of Inspection and Test (9-2) is executed by the Chief Inspector on all equipment sold to Cleveland, Ohio based on the Inspection Report. In the past a similar certificate was executed for Los Angeles, California.

1.2 PRESENT QUALITY CONTROL ORGANIZATION, PROCEDURES AND RECORDS MAINTAINED.

The quality control of castings is a responsibility of the Foundry Superintendent. Indicative of this are the reports which are prepared by him, at his direction, or based on information he submits to the Accounting Department. These foundry and Accounting Department reports pertaining to operations and quality of product are submitted directly to the Vice President of Manufacturing and are as follows:

Monthly Charging Record (9.3). This lists by day for the month the Heat Number, the quantity of charge to one of the two cupolas in terms of pounds of (i) Coke, (ii) Limestone, (iii) Foundry Pig Iron, (iv) Auto Steel, (v) Purchased Cast Iron, (vi) Foundry Returns, (vii) Silicon, (viii) Manganese, and (ix) Treating Metal. Also included is the total metal charged daily. For the month of November 1953 the total coke used was 271,800 lbs., and total daily cupola metal charged was 1,139,799 lbs. This is a coke-metal ratio of approximately 4.2. This ratio has been in evidence for some previous time and at present is about the same. For highly efficient cupola operation - melting - the amount of iron melted per pound of coke usually averages from 8 to 1 and much of the time as high as 10 to 1.

Daily Heat Report (9.4). This lists for the day's operation of the cupola (i) the operator's name, (ii) the weather conditions, (iii) the name of coke manufacturer, (iv) the size of coke, (v) the coke bed height above tuyeres, (vi) the coke bed weight, (vii) the diameter of tuyeres, (viii) the condition of the iron scrap and that of the steel scrap, (ix) the time air on, (x) tap time, (xi) amount tapped, (xii) pressure air - ozs., (xiii) pounds of coke splits, (xiv) whether chemical analysis specimens and physical test specimens are taken, (xv) whether there were "shutdowns" during day, (xvi) destination of metal tapped - generally to "line" or to "floor". Initial tap time is usually about 8:30 a.m., and final tap time is about 3:00 p.m. with about twenty-five taps continuously during the day except for a shutdown of one hour for lunch.

Daily Sand Report (9.5). This lists at half-hour intervals molding sand (i) permeability, (ii) green composition, (iii) percent moisture, (iv) dry

shear strength, and (v) flowability. Also listed are the compositions of (i) the system molding sand, (ii) the system facing sand, and (iii) the floor facing sand. Three values taken at different times are given for both the above listed numbers, (ii) and (iii), sands in terms of permeability, and so forth.

Tensile Test Report (9.6). This lists by day for a week's operation the number of samples (usually four a day), original diameter, area, and under the column "Elastic Limit" the load and the load converted to lbs. per square inch. These values as received are plotted daily on a wall-chart in the office of the Vice President of Manufacturing.

Transverse Test Report (9.7). This lists by day the number of sample, the dimensions, the centers of support, and under the column for "Deflection" the load and reading and in another column the "breaking load". Sample is 1.2" x 13" on 12" centers. These values as received are plotted daily on a wall-chart in the office of the Vice President of Manufacturing.

The information contained in both the Tensile Test Report and the Transverse Test Report is copied onto another form which is dittoed and on which only one day's information is given. This report is delivered to the Vice President of Manufacturing every morning. The two forms listed above are available to the Vice President of Manufacturing and are retained in the Foundry Office.

Chemical Analysis Report (9.8). This is prepared by Charles C. Kawin Co. of Buffalo, New York, to which company drillings of "Heat" samples are sent for chemical analysis. These reports are mailed to the cupola operator who sends them to the Vice President of Manufacturing via the

Foundry [illegible]. This report lists on a daily [illegible] the Heat Number, Tap Number, the date of Heat and the percentages of the following: Silicon, Manganese, Carbons (as graphite and combined), Phosphorus and Sulphur. It is to be noted, however, that the report information is received first as a TWX message by company TWX operator within twenty-four hours from time of mailing "Heat" samples and is delivered immediately to the Vice President of Manufacturing. The mailed report usually arrives within two days of [illegible] mailing "Heat" sample.

<u>Daily Analysis Foundry Scrap Reported (Iron and Brass) (11.15)</u>. Based on Foundry reports the Accounting Department prepares this report which lists for iron and brass: (i) Ticket number of lot, (ii) Size of valve or part, (iii) List Number [illegible] 13 [illegible], (iv) Unit Number (molding unit), (v) Description of scrapped item, (vi) [illegible] scrapped, (vii) Unit weight, (viii) Total weight and (ix) reason for scrap, such as "dirt", "core shift", "drop", "shrink", and so forth.

<u>Monthly Scrap Breakdown Report (9.9)</u>. This report lists by date for the month: (i) Total metal charged, (ii) Good castings, (iii) Scrap castings (except from machine shop), (iv) Daily percentage yield and daily percentage scrap (based on total produced), and the sand-casting defects due to (v) Shrinks, (vi) Crushes, (vii) Dirt, (viii) Broken, (ix) Misruns, (x) Runouts, (xi) Poured short, (xii) Scabs on buckles in cores or molds, (xiii) Blows in cores or molds, (xiv) Penetration and fusion, (xv) Shifts, (xvi) Pattern Shop, (xvii) Slag and inclusions, (xviii) Cores missing or set wrong, (xix) Swells, (xx) Drops, (xxi) Sloppy molding, (xxii) Misc. Also listed at bottom is the "End of Month" percentage yield and percent-

age scrap as well as cumulative to date total metal charged, total good castings and total scrap castings (except for machine shop). Given also is the cumulative to date percentage yield and percentage scrap.

The Machine Shop Superintendent submits to the Vice President of Manufacturing two reports on quality of product as follows:

Daily Scrap Report (9.10). This lists the scrap detected in the machine shops by (i) quanity, (ii) time of day, (iii) part size, (iv) description of part, (v) total weight and what metal, and (vi) reason for rejection. Many rejects are caused by casting defects. Few defects are due to machine shop error.

Monthly Analysis Machine Shop Scrap(11.17). This lists by responsible department the hours of machine shop time wasted due to machine shop error and the time wasted due to foundry error along with the corresponding value of these hours.

The Vice President of Manufacturing studies the above referenced reports and other intra-company reports pertaining to quality of product and verifies for top management that the metal poured daily meets the engineering standards in terms of chemical composition and tensile strength. Any trend toward lower tensile strengths or increased silicon or phosphorus contents serves as an indication that the charging and melting operations need to be checked. Especially since about twenty-five tons of metal are poured daily, the right composition must be obtained to give required engineering properties in the finished products. Standards of quality and quality control of products are the primary responsibility of the Vice President of Manufacturing. No other person in the organization has the functional responsibility for an overall plant quality control program.

2. APPRAISAL

2.1 SCOPE

Since quality standards and controls often are not defined and understood by all Company personnel, product and scrap costs cannot be determined accurately. Quality control in the broad sense provides a common language that may be used by all design, production and inspection personnel as well as by cost control, quality control and top management personnel. Therefore this appraisal aims to reach recommendations pertinent to quality improvement which are amenable of early accomplishment and which at the same time probably can be paid for through savings effected within one year of putting the recommendations into effect. This appraisal aims also at additional recommendations pertinent to quality improvement on an overall basis beyond the time of one year, which appear to be worthy of consideration by management.

2.2 INSPECTION

The present two inspectors are maintaining a high quality of product shipped by their own direct efforts and by obtaining cooperative production-employee vigilance in detecting possible scrap. The Chief Inspector is most diligent in safeguarding the quality of product. He expends a great deal of effort and time in segregating scrap from good product. Unfortunately he does not have much time to extend his inspection and product knowledge back into actual production. Since about 75% of the inspector's time is given to visual inspection of castings and machined castings, he has practically no time for corrective inspection of possible scrap producing sources.

Careful analysis of the causes of scrap and their correction would utilize the time of the inspectors more profitably. For example, detailed random inspection of molds and cores on a lot basis should better insure the proper fitting of cores in the molds and should help to maintain proper dimensions on finished castings. In time, with quality standards and controls established, the ideal inspection might be called preventive inspection. This would detect (on line production) possible future scrap-producing operations and before more than a few pieces of defective product were produced. Realistically, however, the application of preventive inspection is probably not feasible at present.

There are three main elements of the quality function; viz., "acceptance", "prevention", and "assurance" of product quality. At present the inspectors perform only the "acceptance" job. They inspect the product, judge product conformance and make disposition. They do not record the inspection data except for the Inspection Report (9-1) for Los Angeles.

Until such time as all required dimensional tolerances are shown on drawings, there should be an Inspection Report, similar to those prepared for Los Angeles orders, completed and filed on every valve 4" and above, and on every hydrant shipped. Such a report should list the actual measured critical dimensions of products and the measured critical tolerances of vital movable components. In time the Engineering Department would be able to put the correct values of these critical tolerances on the blueprints. At present these tolerances are used in assembly of valves and are not stated on the assembly drawings. These tolerances pertaining to operating mechanisms are the re-

sult of years of worker experience and skill and are used by the machinists and the inspectors in final assembly and inspection. Due to this condition there is no guarantee that any two ostensibly identical products have the same dimensional tolerance levels or ranges.

2.3 QUALITY CONTROL

Last year the loss to the Company because of scrap was estimated at $300,000. The scrap averaged about nine percent. Logical questions to ask are: "Why this loss?"; "Why this high scrap percentage?"; "Is the situation better now?"; and "Is a quality control program in effect?".

Since the many possible reasons for scrap occurrence are known to management, there is no reason to list these reasons here. It is most pertinent, however, to inquire as to the adequacy of present inspection and quality control.

The forms and reports (Appendix 9) which are described under "Findings" of this chapter are necessary to operations. Each report fulfills a definite managerial need. For example, the required quality of metal poured is assured by the chemical analysis report and the tensile and transverse test reports. Similarly the other reports listed either assure quality or give an indication of the state of quality.

By abstracting certain data these reports can provide management with some of the information upon which action can be taken to reduce the estimated yearly scrap loss of $300,000. From a study of two presently used reports (7.6 and 11.15) a combined Scrap and Production Record was produced (Fig. IX-1). It must be noted that this

SCRAP AND PRODUCTION RECORD - 6" 13A Hub-Cases from Line Units 1 and 1A

Month	Pcs. Scrap	Unit Weight	Total Weight	Reason: Drop	Reason: Poured Short	Reason: Broken in Shakeout	Reason: Run-out	Total Produced	Total Weight	Percent Scrap
Jan.	1	110	110	x				234	25740	
"	3	110	330	x						
"	1	110	110	x				214	23540	
"	2	110	220	x				234	25740	
"	5	110	550	x				216	23760	
"	3	110	330	x				186	20460	
			1650						119240	1.3
Feb.	3	110	330	x				238	26180	
"	3	110	330	x						
"	3	110	330		2 - x	1 - x		180	19800	
"	7	110	770	x				188	20680	
"	3	110	330	x						
"	6	110	660	x				240	26400	
"	3	110	330	1-x	1 - x	1 - x		240	26400	
"	1	110	110	x						
			3190						119460	2.6
Mar.	3	110	330	x				234	25740	
"	5	110	550	x				234	25740	
"	4	110	440	2-x	2 - x					
"	4	110	440	3-x			1 - x	234	25740	
			1760						77220	2.4

Fig. IX-1 (Sheet 1 of 2)

SCRAP AND PRODUCTION RECORD - 6" 13A Covers from Line Unit 2

Month	Pcs. Scrap	Unit Weight	Total Weight	Reason: Drop	Reason: Broken in Wheelabrator	Reason: Crush	Reason: Runout	Reason: Shrink	Reason: Pour Short	Total Produced	Total Weight	Percent Scrap
Jan.	4	35	140	x						260	9100	
"	3	35	105	x						232	8120	
"	7	35	245	x						284	9940	
"	5	35	175	x						252	8820	
"	3	35	105	x								
"	4	35	140	x								
"	5	35	175	3-x	2 - x							
"	5	35	175	x								
			1260								35980	3.5
Feb.	27	35	945	7-x		20-x				72	2520	
"	5	35	175	1-x			4-x			180	6300	
"	12	35	420	8-x						180	6300	
"	3	35	105	x						272	9520	
"	7	35	245					x		144	5040	
"	7	35	245	x						292	10220	
"	17	35	595	10-x				6-x	1 - x	284	9940	
"	2	35	70	x						284	9940	
"	10	35	350	8-x	2 - x							
"	13	35	455	x								
"	5	35	175			x						
			3780								59780	6.3
Mar.	13	35	455			x				84	2940	
"	8	35	280	x						284	9940	
"	17	35	595			11-x	3-x	3-Shakeout		284	9940	
"	23	35	805			22-x		1-Shakeout		256	8960	
"	39	35	1365	9-x		27-x	3-x			284	9940	
"	13	35	455	9-x	1 - x			3-Dirt		284	9940	
"	10	35	350	7-x			3-x			284	9940	
"	24	35	840	23-x			1-x					
"	11	35	385	x								
"	4	35	140	x								
"	5	35	175	x								
"	3	35	105	x								
			5950								61600	9.6

Fig. IX-1 (Sheet 2 of 2)

record includes only scrap reported by the Foundry; about 85% of all scrap reported. This Scrap and Production Record gives for one product: (i) pieces of scrap, (ii) reason for scrap, (iii) total production (from which the scrap was obtained), and (iv) percentage of scrap. This report answers the first question required to be answered in a quality control investigation: "What is the situation?".

Sheet 1 of Fig. IX-1 gives data on scrap for the 6" List 13A Hub Cases produced in January, February and March of 1954. The scrap percentages are all under three percent! This indicates that all factors involved in producing this casting are under control. The design, the pattern, the foundry raw materials and equipment and the foundry personnel are all contributing to make this high quality product. Sheet 1 of Fig. IX-1 proves that the foundry can produce, on a mass production basis, good quality castings consistently. Sheet 2 of Fig. IX-1 gives data on scrap for the 6" List 13A Covers produced in the same period of this year. The scrap percentages are all over three percent: 3.5% for January; 6.3% for February; and 9.6% for March. This indicates a significant difference in the scrap production and suggests some difference in production.

This leads to the second question to be answered in a quality control investigation: "Why the condition?". Here again all factors involved in producing the 6" Covers are suspect. However, from the evidence of high quality given in the case of the 6" Hub Cases, the factors of sand, metal and production personnel may be eliminated as possible causes, since essentially the same sand, metal and personnel

were used for production of the two castings. Also the two castings are considered to be about equally difficult to cast and the design of each to be about equally complicated. Investigation then led to the type and condition of pattern equipment and the type of molding machine used for these two items. The 6" List 13A Hub Case is molded on Line Units No. 1 and 1A using an aluminum matchplate and magnesium booking core box about two years old. The 6" List 13A Cover is molded on Line Unit 2 (somewhat the same as Units 1 and 1A but without "squeeze") using an aluminum pattern, alminum plates and an aluminum corebox about twelve years old. The hand-ramming on Line Unit 2 was found to give the sand-packing equivalent to that obtained by "squeeze" on Units 1 and 1A. The condition of the pattern was then checked about the first week of April. Information obtained from the Foundry Superintendent, the Chief Inspector and the Foreman, Pattern Shop, was to the effect that the twelve-year-old pattern was worn beyond satisfactory use and was the cause of most of the defects in the 6" Covers. This apparently was the answer to: "Why the Condition?".

The third question to be answered in a quality control investigation is: "How can the condition be corrected?". The answer was obvious: replace the old metal pattern equipment with new metal pattern equipment.

The last question to be answered in a quality control investigation is: "Who is to take action?". In this case the Foundry Superintendent recommended, on a Pattern Request form, purchase of the needed metal pattern equipment, to the Vice President of Manufacturing. No

written justification for purchase of this equipment, which was estimated to cost about $2500, was attached to the Pattern Request. Scrap percentages based on production records for the 6" Covers were not available, through Company channels, to justify the request for new pattern equipment. Neither was the loss in dollars due to increased scrap - now over nine percent - available as a record to justify the request.

Very naturally the Vice President of Manufacturing needed cost figures to substantiate the purchase of the recommended pattern equipment. In addition he needed information as to whether or not the old pattern equipment had to be shipped to the outside Patternmaking Shop and, if so, the effect on scheduled production. After about two weeks a decision was made to send the old pattern equipment to the outside Patternmaking Shop and have new pattern equipment made.

Drawings necessary to make the aluminum pattern, plates and corebox were not complete. The vendor required complete drawings or the old equipment. The old equipment had to be taken off the "line" and sent. In the event production is scheduled for this item the old pattern equipment must be returned from the vendors. This is not a good situation, but because of the lack of complete metal pattern equipment drawings it is the price that must be paid to obtain the new metal pattern equipment which will assure satisfactory quality of product and a lower scrap loss.

Study of the above example indicates the lack of quality control and the reasons why the scrap rate, as of now, cannot be systematically lowered to a more reasonable value of five percent, which is considered "good", and to an attainable value of three percent, which is

considered "excellent" by foundry managements.

One reason for the high scrap rate continuing is that no record basis exists upon which top management can take priority action. The scrap as now reported is not related to total production on an item basis. Fig. IX-1 gives data for the 6" List 13A Hub Cases and Covers in terms of scrap percentages on a cumulative monthly basis. Compilation of similar records for all the "line" products is presently possible due to the excellent records maintained by the Accounting Department, but is not done. Such monthly records as Fig. IX-1 for all products would give top management the facts on the scrap situation. These records would show (i) scrap percentages by product item, (ii) the product items which were low in scrap and those which were high in scrap, and (iii) where investigative action was most needed to find the reasons for scrap. Furthermore a factual basis would exist for monthly payments of incentive pay for low scrap produced to the high quality molding crew directly responsible and to the personnel on "melting", on "pouring", and on "shakeout" on a percentage basis. The above applies also to the Brass Foundry and to the "floor" products with one major difference. An incentive system for the "floor" molding and "pouring" would probably have to be on a quarterly pay basis. The period in which all scrap from the "floor" is detected is sometimes as long as three months, since the production time for a large valve can take three months or so.

In order to obtain the complete record of scrap by product item it would be necessary to assign a separate Lot Number to each day's run of a particular casting. This is not done at present. A Lot Number

is necessary in order to identify the scrap resulting from each lot. For example, a Lot Number could be assigned to a day's total run of 260 6" List 13A Covers at "shakeout". A metal tag with this Lot Number stamped on it could be attached to the pallet or pallets carrying the 6" Covers and remain as a source of identification from "shakeout" through final machining. This should provide a basis for accurate reporting of all scrap resulting from the original production run of 260 6" Covers.

Similarly the particularly bad situation on scrap in the Brass Foundry could be recorded. When a scrap rate of 25-50% continues in effect, it is evident that corrective action is needed most urgently. A careful study as to the possible causes of the scrap should be made. Such an analysis may show that incorrect temperature of poured metal and sloppy pouring by Brass Foundry personnel is the cause of most of the scrap. If so, perhaps foundry personnel can be motivated by supervisors and incentive pay to decrease scrap. As a last resort in the case of a brass item which gives a high scrap rate consistently when produced in the Brass Foundry, an order for the item should be given to an outside brass foundry for casting. By inquiry of the outside brass foundry information on scrap percentage for that order could be obtained. Probably this scrap percentage would be lower than that obtained previously in the Company's Brass Foundry. If so, this would validate the Company's decision to place a local high scrap item order with an outside foundry. The Company's Brass Foundry personnel then should be informed of the scrap rate incurred on the work put out on order. Such information could be passed on in a form similar to the suggested Scrap and Production Record (Fig. IX-1).

A start on quality control in foundry and machine shop is possible by the procedure outlined in preceding pages. The existing reports, Daily Analysis Foundry Scrap Reported and Daily Foundry Production Schedule (which is used as a report) make possible the determination of scrap percentages per product item on a cumulative monthly basis. Once a lot numbering system is employed, defects in quality and cause of defects can be traced more easily and quickly. Also, more than just foundry scrap can be related to production. Scrap detected in the Machine Shops and scrap detected in final assembly test, such as in the case of hydrant extensions, could be related to production by the Lot system.

Further development of the Scrap and Production Record to include costs of scrap would be most advantageous. Based on only a month's record of high scrap for an item (in the form of Fig. IX-1 with costs included), it may be possible to ascertain the direct contributing cause, to recommend the corrective action and, where replacement, or new inspection equipment is needed, to buttress requests for such equipment with factual cost figures.

It is known that many cast product defects are caused by badly worn patterns. What is not known by many foundry managements, however, is the most economical time of reworking worn patterns or replacing worn patterns with new patterns. Only by submitting cost figures which reflect future possible savings versus future certain scrap losses by product item can management be convinced that, for example, a metal pattern replacement must be ordered now. This thought applies to all quality control cost dedisions.

On seven separate days count was made of defective hydrants which required disassembly. On each observed day from one to as many as five hydrant extensions in completed assembly were deemed to be scrap by the Hydrant Department. These completely assembled hydrants had to be disassembled, hydrant extensions replaced and, in some cases, again disassembled after reassembly when it was found that the replacement hydrant extension was also defective under pressure test. Cost figures here of scrap material and lost labor assembly time which could be effective labor assembly time are needed. Such cost figures could be compared with the cost of building (or purchasing) and operating a hydrant-extension pressure-test rig. These pressure tests, to be most effective and economical, if it were decided to make them, should be made on hydrant extensions prior to their being sent to the Machine Shop.

2.4 ECONOMICS OF QUALITY

From the economics point of view the basic quality problem, including inspection, is to determine the optimum balance between cost of quality and value of quality for each quality characteristic. Quality characteristic refers to the elemental building block out of which "quality" is constructed, ie., a physical or chemical property, a dimension, limits on chemical impurity in metal, etc. Value of quality is a composite of (i) value inherent in the design and (ii) value inherent in the conformance to that design. Often"quality" refers to quality of product design and at other times to the different meaning - quality of product conformance.

There is an optimum to quality of design (see Fig. IX-2)[1].

1. Juran, J.M., QUALITY CONTROL HANDBOOK, pp. 7-8, McGraw-Hill Book Company, New York 1951.

[illegible]

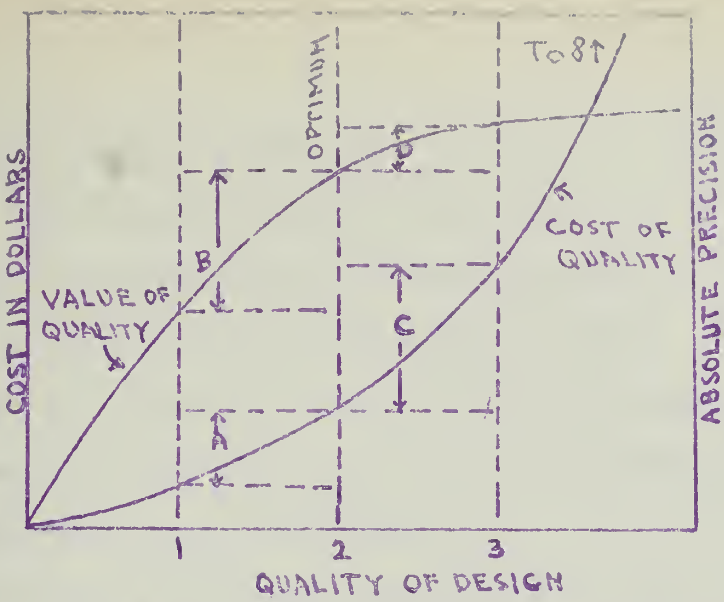


Fig. IX-2 Economics of quality of design. Quality at level 2 is the most economical. A drop to level 1 reduces the cost by A but reduces the value by B, which is greater than A. A rise to level 3 increases the value by D but increases the cost by C, which is greater than D.

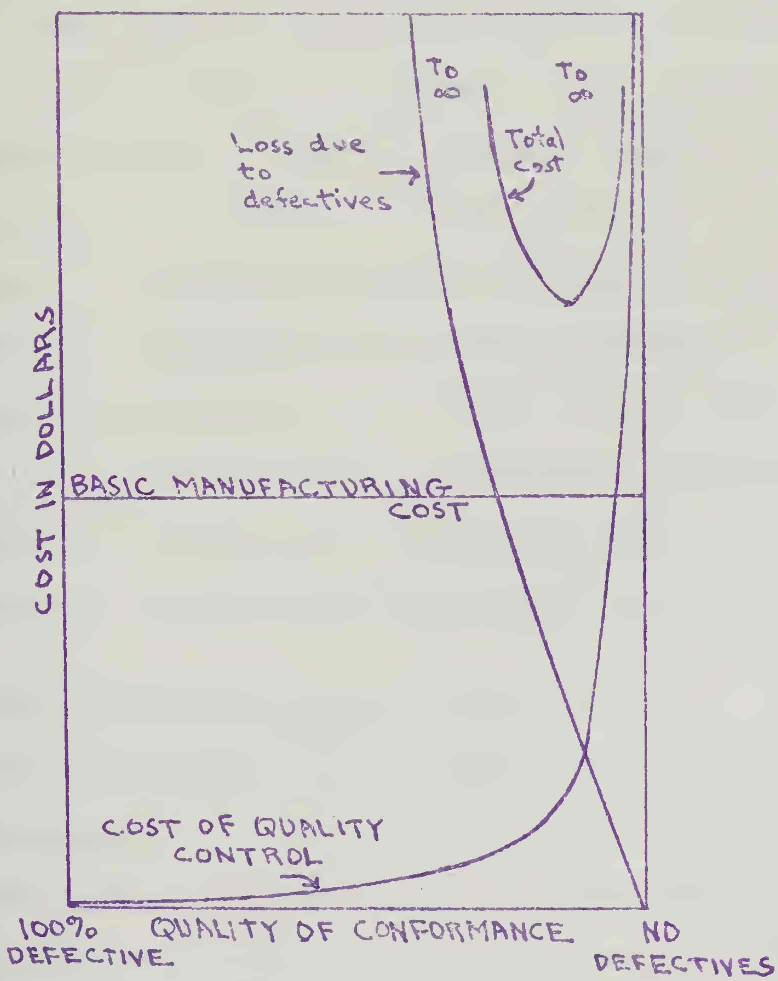


Fig. IX-3 Economics of quality of conformance.

Above this optimum the increased cost of achieving greater quality of design more than offsets the greater market value of the finished product. Below this optimum the reduction in cost of manufacture is more than offset by a still greater reduction in value of product. In like manner there is seen to be an optimum to quality of conformance (see Fig. IX-3). Increased conformance reduces the losses due to defective product and lack of conformance results in disaster.

Usually an inverse relationship exists between cost of higher quality of product design and cost of higher quality of product conformance. The more the cost of higher quality of product design, usually the less the cost of product conformance. This means that usually less scrap, fewer reworks and more good product result at the production source. This further results in a decrease in shop costs and since there are fewer defects, usually a decrese in customer complaints follows.

This section was written to emphasize that an end result of quality control is improvement in quality by any means possible within the limitation that expenditures for a quality improvement do not exceed cost savings for that improvement, preferably on a time basis of about a year. Once the substantial part of the cost of a quality improvement has been paid for out of attendant savings, subsequent yearly savings should be possible due to the quality improvement being in effect.

2.5 ORGANIZATIONAL RESPONSIBILITY FOR QUALITY

The Company catalog (H-1) on page 1 states "Rensselaer has always placed quality first in the manufacture of its products, and has made it a Company policy to be continuously working toward even greater improvements in product design". Under FINDINGS in this chapter it was

stated that "Standards of quality and quality control of product are the primary responsibility of the Vice President of Manufacturing. No other person in the organization has the functional responsibility for an overall plant quality control program".

All personnel involved in production of product are expected to cooperate in maintaining quality at all times. Since standards for all critical quality characteristics of product and standards for production processes are not always known to production personnel concerned, defective products can be produced. The scrap rate attests to the fact that defective products are produced. In addition, since these standards are not always known by production personnel, deviations from quality standards which can cause defective products often cannot be detected quickly so as to bring the process into control. This permits the scrap rate to continue. Some remedial stopgap measures are often put into effect by the line supervisors, principally in the foundry, to lower the percentage of defects. Often as not these stopgap measures do not solve the production quality problem. Since basic data on line molding machine performance, pattern equipment condition and wear, temperature of metal when poured, operator care and other contributing factors involved in production are not recorded or known, definite assignment of cause for defective product, most of the time, cannot be made accurately. More than this, few remedial measures based on recorded production quality facts can be recommended. However, remedial measures based on past experience and judgment of the production employees involved, the Chief Inspector, the Foundry Superintendent, the

Pattern Shop Foreman, the Machine Shop Superintendent and Foremen and the Chief Engineer often would suffice to correct or partially correct the defect in product or the process causing defects. Many good remedial measures to lower scrap rate, to improve design or to sell more of product fail of accomplishment for many reasons.

Foremost in the minds of the key Company personnel responsible for the expenditure of funds for new equipment and special material is probably the thought that the requested expenditure must be necessary for operations beyond all doubt. The justification must be capable of withstanding scrutiny from all angles and at the completion of such scrutiny still be justified - especially from the viewpoint that any expenditures for new equipment, other than major capital equipment, show a savings within a period of about one year. In addition the proposed expenditure must be within the budget allowed. It appears that at the present time many of the aforementioned remedial measures for product or production process improvements advanced by Company personnel are not assessed sufficiently in detail, including a cost analysis as to savings potentially possible, by any one qualified person such as a Quality Control Manager or by a working group on Quality Control in committee action. The emphasis on production, personnel supervision and industrial relations leaves little time for accomplishing a balanced and planned quality control program by the Vice President of Manufacturing and his key supervisory personnel.

From an organizational viewpoint, Chapter 3 of Juran's QUALITY CONTROL HANDBOOK outlines possible organizational realignments

so that the quality function of a company can become a fulltime responsibility of one qualified individual, where justified, or of a working committee. Juran develops a form of organization of the quality function by subdividing it into three main elements as follows:

i) "Acceptance. This is the day-to-day job of measuring the product, judging product conformance, making disposition and recording date." (It often includes such incidental functions as calibrating hydrostatic gauges and salvaging operations as in the case of Rensselaer Valve.) "The Head of this organization or group is usually called the Chief Inspector.

ii) "Prevention. This includes quality control in its various aspects; such as quality standards for personnel performance, equipment performance, economic or cost studies, process-capability studies, instructions to Chief Inspector as to sampling plans to use, standards and procedures for inspection and data to record, analysis of data, use of statistical methods, and the associated training of personnel in quality control. The head of this organization or group is often called Chief, Quality Control Engineering.

iii) "Assurance. This is the "high-level" job of preparing digests of information on quality and presenting this information to top supervisors and to such persons as the Vice President of Manufacturing, the President and the Board of Directors".

Often all three of the above elements report to a single person or, in a small company, a single person may be personally responsible for (ii) and (iii) and have a Chief Inspector reporting to him for the first function of "Acceptance". Such an individual often is called a Quality Control Engineer and usually reports to the Vice President of Manufacturing.

At this point it appears appropriate to ask the questions:

i) "Upon the basis of what facts, including cost studies, are decisions concerning quality of product design and quality of product conformance made and by whom?"

ii) "Are such decisions on product specifications, purchase of new production equipment, revised operating procedures and inspection standards arrived at by coordinated committee action of personnel concerned or must such decisions be made by one person on incomplete data in response to need for corrective action in an attempt to reduce scrap?"

iii) Does the Vice President of Manufacturing need a qualified fulltime Quality Control Engineer or Quality Control Committee or both?

Answers to these questions are left to top management. Recommendations follow.

3. RECOMMENDATIONS

3.1 BASIC

The recommendations following are predicated on the one basic recommendation that the Company establish a position of Quality Control Engineer reporting to the Vice President of Manufacturing, that the position be filled if possible by a present employee capable of learning quality control techniques within a reasonable time; and if the latter is not possible, by employment of a quality control engineer or an industrial engineer.

Once a trained person is ready to tackle the quality control of product he should consider the following first:

i) What is the present cost of scrap and rework?

It is important that accurate data be obtained to show these losses before the quality control program gets underway, since without this firmly established it may be most difficult to substantiate the investment that top management is making. It is not sufficient to get scrap figures alone; it is just as important to get production figures, by inspection lots, so that scrap and rework may be shown as a percent of good work.

ii) What is the present cost of inspection? This should include inspection cost as percent of direct labor and when possible by product item or by general classifications such as cast-iron foundry, brass foundry, machine shop and assembly.

iii) What is the cost of servicing and replacing field returns?

This item should decrease as the quality control program continues.

iv) Who needs to be trained first in the techniques of quality control?

The inspectors, the line production superintendents, the design engineers and someone from the Accounting Department staff.

From reading the above four considerations one might be inclined to say that the first three could be answered by the Accounting Department. This is true but once the answers are obtained who will take action and make decision-recommendations on changes in equipment, tolerances and operations to top management based on this information? The answer is the Quality Control Engineer who is concerned with the technical operations as well as the costs and quality of products.

3.2 SPECIFIC

i) The reporting of scrap from the foundry and the machine shop should include production figures and scrap figures, by item, by item cost and by inspection lot if possible, so that scrap percentages by item can be shown first on a monthly bases and, in time, on a weekly basis.

ii) Line supervisors and employees (by work-unit breakdown) should be informed of the results of (i) above - i.e., the scrap percentages by item and the costs as losses.

iii) The inspectors, production supervisors, engineers and an accountant should be encouraged to enroll at Company expense and on Company time in a course in quality control given at a nearby educational institution, or such instruction should be given by the Quality Control Engineer when employed.

iv) Employees should be informed repeatedly of the importance of quality and that quality makes sales which in turn make jobs. This can be done by insertion of articles on quality control in the Company's weekly newspaper or newsletter.

v) Beneficial suggestions on quality from employees should be encouraged and employees should be paid a percentage of savings effected and given recognition if suggestion is effected. Expeditious action on suggestions must be taken or morale will be affected adversely.

vi) In order to capitalize on results from the above recommendations, establishment of the position of Quality Control Engineer reporting to the Vice President of Manufacturing and early assignment of a qualified person to this position is recommended.

vii) An Inspection Report showing Ditto Number and similar to Form 9-1 should be completed and filed on every valve 4" in size and above and on every hydrant shipped.

CHAPTER X

INDUSTRIAL RELATIONS

1. FINDINGS

1.1 GENERAL

The Rensselaer Valve Company employs 376 people. Of this number 303 are engaged in non-supervisory manufacturing operations and 73 are engaged in executive, administrative, supervisory, sales or clerical capacities.

Those persons engaged in non-supervisory manufacturing operations will be referred to in the remainder of this chapter as "blue collar workers". The Company operates a Union Shop, and for purposes of collective bargaining it is divided into three units. All blue collar foundry workers other than molders, coremakers and apprentices are in a unit represented by Local 60 of the International Brotherhood of Foundry and Metal Employees. All molders, coremakers and apprentices are in a unit represented by Local 108 of the International Molders and Foundry Workers Union of North America, affiliated with the American Federation of Labor. Workers in the Machine, Pattern, Assembly, Maintenance and General Labor Departments are in a unit represented by Local 120 of the International Brotherhood of Foundry and Metal Employees.

The other employees of the Company are not organized or included in any bargaining unit.

1.2 LABOR RELATIONS

There is no single individual charged with the responsibility for labor relations for the Company as a whole. Each major department head is responsible for labor relations within his department. The

Treasurer is responsible for assuring that the Company's personnel policies for salaried employees are uniformly applied. The Vice President in charge of Manufacturing, who will be referred to as the Plant Manager in the remainder of this chapter, is responsible for labor relations involving Blue collar workers.

The International Brotherhood of Foundry and Metal Employees, of which Locals 60 and 120 are a part, is a relatively small, unaffiliated, international union. Its membership is concentrated in the northeastern United States and southeastern Canada. It is organized on an industrial basis. The president of the international is employed with the Company and serves as a committeeman in Local 120. The employees of two other companies in this area are represented by locals of the International. Locals are organized and bargaining is done on a company basis and there appears to be little collaboration between the locals.

Local 60 has been in existence at Rensselaer Valve Company for many years representing foundry laborers. In 1939 it increased its area to include employees in the Machine, Pattern, Assembly, Maintenance and General Labor Departments. In 1941 the aforementioned employees broke with Local 60 and formed what is now Local 120.

Local 108 of the International Molders and Foundry Workers Union of North America is the bargaining agency for all molders, coremakers and apprentices employed by the Company. This same local includes membership from six other companies located within the Troy, Cohoes, Waterford area, but all bargaining is done on a company basis. The secretary-treasurer of Local 108 is an employee of the Company and

is chairman of the union committee at Rensselaer Valve. One of the trustees of the Local is also an employee of the Company.

The Company has entered into annual contracts with each of the three bargaining units. This report concerns itself with the contracts expiring April 30, 1954. Each of these contracts gives coverage to approximately the same general categories but differs in details as to how the contracted agreements will be performed. The categories covered in each contract are as listed in Fig. X-1. The primary differences are: (i) In both Local 60 and Local 120 members lose continuity of service for the purpose of seniority upon being promoted to a supervisory position. In Local 108 a member upon being promoted to a supervisory position retains continuity of service for seniority purposes for six months after the promotion. (ii) The manner in which vacancies are filled varies between locals. These differences will be discussed in detail in another section of this chapter. (iii) Local 108 will not agree to a pre-employment physical examination for new employees entering that local. (iv) All locals are covered by the same incentive plan. The basic pay rate for the members of Local 60 is the same for all members; however, a differential is added to this base for employees performing certain duties. The members of Local 108 all receive the same basic rate of pay, since there are no apprentices employed within the Local at this time. The basic rates of pay for members of Local 120 differ depending upon the duties performed.

All contracts are written in such a manner as to comply with the requirements of the National Labor Relations Act as amended.

Each contract contains a copy of Shop Rules and Regulations. They are identical for each contract and are to be used for maintaining shop order and discipline. The penalties to be invoked for violations range from a warning to dismissal, depending upon the seriousness of the offense and whether it is the offender's first, second, third or fourth violation. In theory a foreman can invoke a penalty commensurate with the offense committed. Actually this is not done even to the extent of issuing a warning without consultation with his shop superintendent, the plant manager and in most instances the shop committee representing the unit to which the employee belongs.

The grievance procedure contained in each contract allows for four steps before arbitration. At the first step the aggrieved employee can discuss the matter with his foreman without a representative of the shop committee present. At all other steps the shop committee presents the matter to the hearing official. The hearing officials for the four steps are: (i) the Foreman involved; (ii) the Shop Superintendent involved; (iii) the Plant Manager; (iv) the General Manager. If the matter is not resolved at one of the first four steps, a request is made to the New York State Department of Labor, Bureau of Mediation for the services of an arbitrator. Both parties to all contracts agree to abide by the decision of the arbitrator. The expenses and fees for the arbitrator will be borne equally by the parties. No arbitrator shall have power to add to, to ignore or to modify any of the terms and conditions of the contracts.

Provisions are contained in each of the contracts for periodic meetings between the shop committees and the cognizant shop superintendent,

and it is implied that such periodic meetings will be held with the Plant Manager. Meetings are held but not in keeping with any set schedule. The Plant Manager attempts to refrain from discussing any controversial issues at his meetings with the shop committeemen unless they have been brought previously to the attention of the responsible supervisors.

There are no set rules and regulations for governing the conduct of the employees not covered by a union contract. No disciplinary action is taken against salaried employees except by major department heads. Neither is there a procedure outlined by which these employees might present a grievance to management. There are no written statements of company policy relating to working hours, vacations, holidays and retirement for salaried workers. Fixed salary ranges and definite step increases, with a fixed minimum waiting time between steps, is not established for each salaried position. Approximate ranges and step increases have been established and are adhered to generally. The Treasurer maintains a watch over salaries in order to maintain uniformity throughout the Company.

	Local Union		
	60	180	120
Recognition (exclusive bargaining agency)	x	x	x
Representation (Shop Committee)	x	x	x
Union Security (all new hires to join within 30 days)	x	x	x
Check Off (individual authorization for life of contract revokable on 10 days notice)	x	x	x
Management (acknowledges management's prerogatives)	x	x	x
Hours of Work and Overtime (establishes normal work-day and week, hours of work for day and night shift, and defines basis for overtime payments)	x	x	x
Seniority (defines seniority as length of continuous service with Company)	x	x	x
(a) Loses seniority upon promotion to supervisory rank	x		x
(b) Retains seniority for six months after promotion		x	
Filling of Vacancies	x		x
Layoff and Rehiring	x	x	x
Holiday and Vacation Provisions	x	x	x
Grievance and Arbitration Procedures	x	x	x
Discharge	x	x	x
Stoppage of Work	x	x	x
Group Insurance	x	x	x
Medical Examination	x		x
Leaves of Absence	x	x	x
Wage and Incentive Plans	x	x	x
Night Shift Differential	x	x	x
Duration of Agreement	x	x	x
Provision for Amendments	x	x	x

(Contd.)

	Local Union		
	60	180	120
Warrant of Authority	x	x	x
Saving Clause	x	x	x
Scope of Agreement and Retirement Plan	x	x	x

Figure X-1

1.3 EMPLOYMENT AND PLACEMENT

The size of the work force is relatively constant. An incentive plan for blue collar workers was installed approximately two years ago. Since that time there has been a moderate decrease in the size of the work force.

There have been no discharges or lay-offs as the result of the installation of this system. The reduction was brought about by not hiring to fill vacancies caused by normal attrition except in those instances where an individual left a critical position and no one in the remaining work force could be moved into that vacancy. This leveling-off was largely accomplished within the first year after the installation of the incentive system. During the past year the hiring rate has been that necessary to keep accessions only slightly below separations.

It is the Company's policy to promote members of the present work force into desirable vacancies when possible. There is no written statement of this policy as it affects salaried workers, but it is written into the union contract for the members of Locals 60 and 120 of the International Brotherhood of Foundry and Metal Employees. In the contracts with these locals it is agreed that when a vacancy occurs in the bargaining unit a notice of that vacancy will be posted for forty-eight hours and members of the unit can apply to fill the vacancy.

Selection to fill vacancies in the bargaining unit represented by Local 60, from the members of that local applying for the advancement, will be made as follows: the employee with the greatest seniority and physically qualified to perform the work will be given a thirty-day trial period. At the end of this trial period the Company must either make his

promotion final or revert him to his former job if his performance has not been satisfactory. During the thirty-day trial period the employee may revert voluntarily to his old job.

Selection to fill vacancies in the bargaining unit represented by Local 120, from the members of that local applying for advancement, is as follows: consideration is given to job knowledge, ability and seniority. Where job knowledge and ability are equal, seniority will be the determining factor. The employee selected for advancement will be given a four-week trial period. During this period, if he is found to be incapable of performing the job, he will be reverted to his former classification at his former rate of pay.

No member of the bargaining unit can change his classification after accepting a posted vacancy, for a period of six months. Employee's application for a change to a lower classification will not be approved by the Company unless it is acceptable to the union.

There is no provision for the filling of vacancies in the bargaining unit represented by Local 108 by promotion from within the unit. This condition exists because all jobs within the unit receive the same basic pay rate. There is a provision, however, in which the Company agrees to discuss with the shop committee seniority, job knowledge, skill and ability when making permanent assignment of employees within the bargaining unit.

When a vacancy exists for which there are no applicants from among the present work force, the Company then makes a new hire. For blue collar workers there are in general three sources of applicants. One is the United States Employment Service; another is from a file

listing persons who have made application for employment previously; and the other is from applicants who have been recommended by members of the present work force. Drawing from any or all of these sources, after an interview and a reference check, selection is made on a thirty-day probationary basis. At the end of the probationary period the employee either is terminated or made permanent. The reference check consists of contacting former employers and two references other than former employers given by the applicant.

All applicants for existing vacancies in the plant are interviewed first by the Plant Manager. If the vacant position is one to be filled by the hiring of a molder or coremaker, he will interview only registered journeymen. After he selects what he considers the three most likely candidates, they are interviewed by the shop superintendent and the foreman for whom the candidate selected will work. If the job to be filled requires skill or job knowledge, a test operation may become part of the interview. As a result of the interview the shop superintendent and the foreman decide jointly which of the applicants will be hired. There are no set performance standards for each type of position against which the applicants' abilities can be checked. All selections are made subject to the successful completion of a medical examination including a chest x-ray, except for those persons being hired as molders and coremakers. There are no set physical standards which successful candidates must meet other than that no indivdiuals are hired who have varicose veins, hernia, tuberculosis or any known communicable disease.

Selection of salaried workers is made by the office head for

whom they will be working. He determines the requirements of the job and the abilities which the successful applicant must possess. He also determines whether any type of skill test will be required. No pre-employment medical examination is required of salaried workers. They, too, are on probation for the first thirty days of employment.

At the time of hiring, each new employee is informed by the individual making the selection of the salary range of the job and the prospects of advancement. He is informed also of the Company's retirement plan, insurance plan, vacation provisions and other services provided by the Company.

1.31 LAY-OFFS AND REHIRING

The provisions for lay-offs and rehiring contained in the contracts with each of the locals provide in general for lay-offs to be accomplished on the order of seniority and for rehiring to be accomplished in the reverse order of lay-offs. The contract with Local 108 varies from the fixed pattern in that all employees hired subsequent to May 1, 1944 must be laid off before the Company can go below a three-day work week. For purposes of lay-off members of Local 108 compete with other members of the unit in which they work; that is, line molders compete among themselves; floor molders among themselves, and so forth.

1.4 RECORDS AND REPORTS

Records relating to payroll, seniority and retirement are maintained in the Accounting Department for all employees of the Rensselaer Valve Company. A record also is kept in the Accounting Department indicating the daily productivity of each worker on incentive

pay. If a worker fails to reach 118 percent productivity or if he exceeds 140 percent productivity, the Plant Manager is notified by the Accounting Department.

In the case of blue collar and salaried workers employed in the shop offices the Plant Manager maintains a file of the papers gathered as a result of the pre-employment investigation conducted at the time they were hired. A separate file of warnings is maintained by the Plant Manager for those employees receiving them. The Industrial Nurse maintains a record on each blue collar employee which shows his attendance and overtime record. This record is available to anyone having a need for it.

For salaried workers the information obtained from pre-employment investigations is filed in the department in which the employee works. The Accounting Department maintains information relating to the employees' payroll status, seniority, insurance, vacation and retirement records. The Accounting Department also maintains an attendance and overtime record for all salaried employees.

1.5 CLASSIFICATION, WAGE AND SALARY ADMINISTRATION

The wages received by blue collar workers depend upon an hourly rate and the number of hours worked, supplemented by incentive pay earned. The hourly rate paid each classof worker is the result of collective bargaining.

The incentive pay system is based on production standards in effect prior to June 30, 1952 equaling 100 percent productivity or standard output. The plan operates on a group basis with each of the

collective bargaining units forming a group. This results in three groups within the plant.

It was agreed by both the Company and the Locals, and it forms a part of the contract between the Company and each of them, that the aim of the system is to increase production by 118 percent to 124 percent or more. No incentive pay is received for production of less than 115 percent. At 115 percentthe workers receive 6.5¢ per hour incentive pay. As group productivity increases, the incentive pay received increases in accordance with the following schedule:

If the Increase in Production over the Standard is:	Production Bonus Pay is:
less than 15%	0
15% but less than 16%	6.5¢ per hr.
16% " " " 17%	7.25¢ " "
17% " " " 18%	8 ¢ " "
18% " " " 19%	9.¢ " "
19% " " " 20%	10.¢ " "
20% " " " 21%	11.¢ " "
21% " " " 22%	13.¢ " "
22% " " " 23%	14.¢ " "
23% " " " 24%	15.¢ " "
24% " " " 25%	17.¢ " "
25% " " " 26%	18.¢ " "
26% " " " 27%	20.¢ " "
27% " " " 28%	21.¢ " "
28% " " " 29%	23.¢ " "
29% " " " 30%	24.¢ " "
30% " " " 31%	26.¢ " "

Each additional 1 percent increase in production beyond 31 percent yields an additional $1\frac{1}{2}$¢ per hour in production bonus. The working of the plan has resulted in an overall increase in productivity of approximately 18 percent.

There is a fifteen cents per hour spread between the minimum and maximum hourly rate for all jobs in Local 120. The contract with

this local provides for advancement from the minimum to the maximum in nine months. Actually this rate often is accelerated when in the opinion of the Plant Manager the worker is performing in a more than satisfactory manner. All workers in Local 108 receive the same basic hourly rate. The members of Local 60 all receive the same base rate but an hourly differential is added to this rate for certain jobs within the unit. The amount of differential added depends upon the job performed.

In 1943 a survey of the clerical, administrative and executive positions at Rensselaer Valve Company was made by the firm of Stevenson, Jordan and Harrison of New York. This survey resulted in the preparation of job descriptions and a point evaluation of them. It established salary ranges for the various positions based on their point evaluation. The range between the minimum and maximum salary varies with the different positions and is dependent upon the starting salary. The company conducting the survey suggested that there be three intermediate steps between the minimum and maximum salary for each position. It also recommended that a merit rating system be installed in conjunction with the classification system and that a salary and wage committee be formed to pass on all salary increases. The data provided by the operation of the merit rating system would be the basis for granting or denying wage increases.

This survey was prompted partially by the fact that the Company desired to raise salaries beyond the ceiling allowed at that time by the Salary Stabilization Unit of the Bureau of Internal Revenue, United States Treasury Department. Government approval of such a plan

would allow increases to be made. The plan was approved and placed in operation until the end of World War II. After government control of salaries was ended, it was no longer necessary for the Company to adhere to the procedures approved by the Treasury Department in order to grant wage increases. Shortly thereafter the Salary and Wage Committee was abolished and merit rating was discontinued. The Company still uses the job titles and job descriptions recommended by the consultants; and the basic wage ranges, corrected for increases in the cost of living resulting since the time they were established, are in general applied today. The heads of the various departments review the records of their salaried employees every six months to determine whether a salary increase is warranted. As a rule, increases are granted once a year. The size of the increase depends upon the opinion of the department head concerning the employee's progress.

New employees for salaried positions are not always hired at the minimum salary specified for a particular position. Their starting salary depends upon their past experience and the availability of a labor supply at the time of employment.

1.6 TRAINING

There is no formal training program for either salaried or blue collar workers. The nearest approach to a training program is a weekly conference held by the Production Manager with the shop superintendents and foremen. The supervisors working for the Production Manager also attend these meetings, and in his absence his assistant conducts the meetings. The Plant Manager attends these meetings when-

[illegible]

[illegible]

[illegible]

every month. The Company publishes a publication [illegible] "The Supervisor's Letter". It is mailed to the home of all supervisors. This publication contains hypothetical problems typical of those with which a supervisor often is confronted. It also contains suggestions for improving employee relations. The problems and suggestions contained in the current issue of this publication are discussed at the weekly supervisors' conference.

The Company also subscribes to certain publications of the American Management Association. These apparently get only a limited circulation. At one time the junior executives of the Company participated in Executive Training Conferences sponsored by the Society for the Advancement of Management. There has been no company participation in these conferences for approximately two years.

1.7 SAFETY

The safety organization is composed of a Safety Inspector, a Nurse, and a Safety Committee. This organization confines its efforts exclusively to the plant and persons engaged in plant operations.

The primary duties of the Safety Inspector are those of an Assistant Inspector in the Inspection Staff. His duties as a Safety Inspector are collateral. It is the expressed intention of the Plant Manager to rotate the responsibility of the Safety Inspector among various members of the plant. The length of time any individual is to perform these duties is to be approximately three months. No safety training has been given to the present incumbent nor to any of the prospective incumbents. At present the job consists primarily of bringing to the attention of the responsible supervisors unsafe con-

[illegible] Safety Inspector [illegible]
Committee.

The Nurse administers first-aid treatment to those in the plant requiring it. She maintains health records on all employees who are given physical examinations at the time of their employment or who have received treatment in the dispensary. She compiles the monthly reports required by the Employees Compensation Board, State of New York. She also performs clerical duties for the Plant Manager. No first-aid stations are maintained within the plant other than the dispensary.

The Shop Safety Committee is composed of the Safety Inspector and a member from each of the locals. It notifies management periodically of unsafe conditions existing in the shops. In the contract with each bargaining unit the Company recognizes the importance of safety provisions in the plant for the protection of the health, life and limb of its employees. The unions agree to stand with the Company in the enforcement of rules and regulations in regard to employees' safety.

Some employees engaged in eye-hazardous occupations or working in eye-hazardous areas do not wear safety glasses. The Company provides safety goggles to those workers desiring them. If a worker requires prescription-ground safety glasses, the Company will procure them for the employee and will defray a portion of the cost. The glasses become the property of the employee.

Eye-hazardous areas throughout the plant are not marked. It is safe to assume, however, that practically the entire plant is an eye-hazardous area. No records are maintained as to accident frequency. From time to time the Company arranges for a survey and a safety drive

sparked by independent safety engineers. There is little evidence of any day-to-day publicity being given to accident prevention.

The Company receives accident prevention literature with posters from the Employee's Compensation Board, State of New York. A member of this organization also meets from time to time with the Safety Committee. The Company also has an arrangement whereby the safety engineer of an insurance company inspects the plant and meets with the committee monthly.

1.8 EMPLOYEE SERVICES

The Company provides its employees with certain benefits which are normally included within the scope of the term, "employee services". There is no individual in the Company's organization who is charged specifically with the responsibility for reviewing the effectiveness of the benefits provided and for determining whether additional ones should be added or perhaps some of the existing ones discontinued.

Among the principal services provided is a retirement plan, a life insurance plan, a sickness and accident indemnity plan, a sick leave policy for salaried employees which grants compensation in addition to that derived through the operation of the sickness and accident indemnity plan, a policy for granting an allowance to persons entering the military service and a policy of supplementing the salary an employee receives while attending a National Guard Summer Camp with enough to make the total of the two dums equal to his base pay with the Company. The total amount of such supplement cannot exceed the employee's base rate for eighty hours.

The minor services provided include the sponsorship of a softball team and a bowling team. The expenses involved in the operation of these teams are defrayed from the receipts of the vending machines located in the plant and offices. Once a year the Company participates with each of the three bargaining units in a picnic.

The retirement plan provides for retirement at age 65 with a monthly income of one hundred dollars for life. The Company supplements the social security benefits the retiring employee will receive with enough to make this total.

The life insurance plan provides every employee who has been with the Company six months or longer a one thousand dollar life insurance policy. This policy is in force so long as the employee remains with the Company, and can be converted within thirty-one days after he leaves the Company.

Every employee is covered by the sickness and accident indemnity plan. Benefits under this plan range from a low of $15 to a high of $40 a week for 13 weeks. The amount received is dependent upon the employee's normal annual earning. No benefit is received under this plan covering the first week of any illness. All sickness and injury from accident of over seven days' duration, where the employee is attended by a physician and is not entitled to benefits under any workmen's compensation law, is compensable under this plan. Employees over 60 can receive benefits for only 13 weeks out of any twelve consecutive months.

Salaried workers receive benefits from the Company as well as from the insurance company if they are ill for more than seven days

or suffer from an accidental injury of more than seven days' duration which is not compensable under a workmen's compensation law. If an employee earns from $30 to $75 a week, the Company pays the employee's salary for the first week of illness. If the employee earns from $325 to $400 per month, the Company will guarantee his full salary for two weeks. If the employee earns over $401 per month, the Company will guarantee his full salary for four weeks. In any instance where the Company pays the guaranteed salary beyond the first week of illness or injury the Company supplements the benefit received from the insurance company with enough to make the total.

All employees are covered by the same leave and holiday plan. The Company grants eight holidays a year and the annual leave granted depends upon the length of service the employee has with the Company. Employees with less than six months' service get no leave. Those who have from six months to three years receive one week. Those with more than three years but less than fifteen years receive two weeks, and those employees who have been with the Company more than fifteen years receive three weeks. The Company's vacation plan is covered in detail in the contracts with each local.

There are drinking fountains located throughout the shops and offices. There are toilet facilities located adjacent to the Upstairs Machine Shop, the Big Machine Shop and the Chip and Clean Room. The toilet space adjacent to the Chip and Clean Room has no fixture in which the employees can wash their face and hands. There is an adjacent room, however, which contains facilities for washing, and lockers. The foundry employees are the only workers provided with lockers.

There is no established means of communication between management and plant workers such as a house organ. Bulletin boards are not maintained in any systematic manner. No suggestion plan is in effect. Publication of a company paper for sales personnel was inaugurated recently.

The Company permits salesmen vending coffee, soft drinks and light snacks to solicit trade.

Adequate parking facilities are provided all employees.

The Industrial Nurse visits as many sick employees as time permits, to provide assistance if needed.

2. APPRAISAL

2.1 GENERAL

This appraisal of the Industrial Relations Program at the Rensselaer Valve Company will be in general terms. Recommendations relating to its improvement will deal in specifics.

From discussions held with Company management and union members, the impression was received that the labor history of the Company has long been one of unrest. This unrest has given cause for strikes and walkouts from time to time. It was conceded by representatives of both groups that labor relations have improved within the past two or three years. There continue to exist suspicions of the other side by both groups, however. The Company is endeavoring to create better labor-management relations. It does not at this time have a closely coordinated plan for achieving these results.

The size of the work force does not demand an extensive industrial relations program; however, there are certain basic elements which are required in any such program if it is to function effectively. Some of these elements are lacking and others need to be developed if the Company's program is to accomplish the desired results.

2.2 LABOR RELATIONS

The contracts between the Company and the bargaining units representing the blue collar workers appear to be reasonable and fair. There are no stipulations which are unduly restrictive as to the manner in which management will operate the Company. The shop rules and regulations contained in the contracts are reasonable but are written in

[illegible]

[illegible]

[illegible]

such a manner that enforcement is difficult. The grievance procedure outlined in the contracts is considered excellent; it is not always followed, however. Grievances usually are handled in a less formal manner. This informality seems to be preferred by the locals and is not objected to by top management. There are indications that some foremen believe that they are being by-passed too frequently and that this weakens their position. In some instances when the procedure is followed decisions made by lower level supervisors are reversed at a higher level. The reason for reversal is not always made known to the supervisor making the original decision.

No grievance has gone to arbitration since 1949. This could be an indication of good labor relations, but it could indicate also that management isgiving in too readily to worker demands. Records of all grievances are maintained by the Plant Manager and are available for review in order to determine whether the Company is consistent in its decision.

There is no document which contains a statement of Company policy toward salaried employees, which compares with the contract provisions guaranteed blue collar workers. This results in some salaried workers not being fully aware of the benefits extended them by the Company. For instance, several salaried workers, when asked, did not know whether the Company's retirement policy extended to include them. There is not statement of offenses and corrective action to be taken which apply to salaried workers in the same manner that shop rules and regulations apply to blue collar workers. Only major

department heads have the authority to take disciplinary action against salaried subordinates. There is no machinery whereby a salaried worker can enter a grievance.

2.3 EMPLOYMENT

Recruitment problems have not been great within the past year. This is due primarily to the fact that there has been an abundant labor supply. During the year 1953 there was a fifteen percent turnover in blue collar personnel and a two and nine tenths percent reduction in the size of the blue collar work force. The turnover experienced was due to 31 quits or removals, 4 deaths, 11 retirements. Included in the quits or removals are: 11 persons who either resigned or were released during their probationary period; 11 who resigned and 5 who were released after their probationary period had expired; and 4 who left the Company to enter military service. During the year 37 new employees were hired and of this number 29.8 percent either left or were released during their probationary period. This would indicate that a review of the selection techniques employed might be in order.

Since the size of the salaried work force is relatively small and turnover has not been appreciable, no detailed study was conducted in order to determine the categories of separations from this group.

For the filling of vacancies involving salaried workers different individuals make selections to fill positions requiring similar skills and aptitudes if the positions are in different departments. The absence of written standards to be used in filling these vacancies can lead to a disparity in skill and aptitudes possessed by individuals hired for like positions, even though there exists a plentiful labor supply.

2.4 RECORDS AND REPORTS

The records kept at present are considered adequate except for the lack of a record showing the periodic merit rating of each employee. Such a record would include an appraisal of the individual worker's performance in relation to quantity and quality. Information is already available for blue collar workers, which indicates quantity of their production, but it is not filed in such a manner that it is readily available for reference in cases involving promotion, salary increase, and retention. Although information required in establishing and maintaining records which will indicate the quality of each individual worker's output is difficult to obtain and evaluate, it is considered mandatory if management is to realize the fullest return from its labor dollars. This applies equally to salaried and blue collar workers.

If all personnel records now being maintained in many different offices were filed in a central location under the control of one individual, record-keeping and evaluation could be improved.

2.5 CLASSIFICATION, WAGE AND SALARY ADMINISTRATION

For an incentive system to be most effective the base pay of the workers must be equal to the prevailing wage for similar work in the same area. A very limited survey of industrial activities within this area indicates that this may not be the case at Rensselaer Valve Company. The difference between the area base pay and the Company base pay for unskilled jobs is not great, but the Company appears to pay a rate somewhat lower than the area rate to its skilled employees. Undoubtedly the Company's employees are aware of this condition.

As was indicated in Chapter V of this report, it was not possible to conduct a work measurement study in conjunction with this survey; therefore no exact information is available on which to base an opinion regarding the time standards presently employed. It appears, however, that some of these standards are quite loose and others are equally severe. This condition can result in an erroneous indication of the individual worker's performance. The Company and the unions recognize this fact, but union membership is reluctant to permit the work measurement survey required if this condition is to be corrected. This reluctance stems from the fact that some workers believe they were short-changed by a previous time study, plus the fact they believe management exerted undue pressure at the time the present incentive plan was installed. They abide by the contract but do not seem to be sold on the incentive system.

Under the present arrangement, whereby an entire bargaining unit forms the group for incentive pay purposes, the workers are willing to abide by those standards which are tight in order to enjoy those which are loose, and which they believe bring the group average performance up to a level higher than that which would be experienced if all standards were correct.

Whereas the operation of the present system has resulted in increased productivity, it is believed that production can be increased further by improving the system.

2.51 SALARIED WORKERS

Increases have been made to the salaries recommended by Stevenson, Jordan and Harrison in 1943, presumably reflecting in-

creases in the cost of living occurring since that time. The accuracy of the estimates concerning the extent of the increases in this area is questionable. There is no policy statement as to how frequently adjustments will be made.

The salary structure provides for a minimum and maximum salary for each position. The maximum is not adhered to in all instances. There is no fixed number of steps between the minimum and maximum range, nor is there any stated increase to be granted between each step. Although consideration is given to granting employees increases every six months, in practice they are not granted more often than once a year. This manner of granting salary increases allows the department heads considerable flexibility, but it works to the detriment of the employees, in that they cannot reasonably depend on fixed increases at definite intervals.

There is no procedure whereby supervisors meet with their subordinates periodically to appraise their performance. This results in the individual worker not knowing how well he is doing his job in the eyes of his supervisor.

The survey conducted in 1943 resulted in the preparation of job descriptions. These descriptions are extremely brief and are lacking in essential details. They do not spell out clearly the full responsibility of the positions, nor do they indicate the relationships between the incumbent and his superior and his subordinates. There exists much confusion over the matter of who works for whom. This confusion could result in lost motion and misunderstandings.

2.6 TRAINING

At present many of the responsibilities normally assumed by foremen in other industries are assumed at a higher echelon in this company. This situation could be intentional and in keeping with the manner in which the Company desires to operate or it could be due to inability on the part of the foremen to assume these responsibilities or to their superior's lack of confidence in their abilities.

If foremen or any other supervisors are to function at their maximum capacity and thereby allow more time to their speriors for performing duties of a more complex nature, these supervisors must be acquainted with all the operatingpolicies they are expected to carry out. They must know also the reasons for these policies. These facts, as well as many others, preclude a "canned" training program from being entirely successful. Training directed specifically at the problems of Rensselaer Valve Company must supplemnt any general supervisory training if the program is to achieve its goal. Such training is not being conducted at this time.

2.7 SAFETY

The safety program now in effect appears to have the enthusiastic support of the labor groups. Management is active in carrying out the recommendations of the safety committee. There is much room for improvement in the safety program, however. The greatest need seems to be for a capable safety engineer or inspector to guide it. Safety statistics relating to frequency and severity of accidents are not being maintained in order that management might keep itself in-

formed of the degree of success experienced in its accident prevention program. There has been a recent improvement in this program but figures are not available which indicate to what extent.

The Company is now paying the maximum rate for workmen's compensation insurance. A successful safety program should reduce this rate sufficiently to offset a considerable portion if not all the expense involved in operating the program.

2.8 EMPLOYEE SERVICES

The Company provides all basic services with the exception of a house organ for plant personnel. The quality of some of these services is dubious. The bulletin boards provided do not appear to be adequate or properly maintained. There are only four shower heads for the entire foundry work force and none for any other plant workers. There appears some resentment on the part of machine shop workers over the fact that they have no such facilities. The rest rooms are not considered as clean as it is reasonably possible to keep them. The present color scheme does not enhance their appearance.

The retirement benefits provided appear to be in keeping with industrial pensions generally.

The Company does not appear to fully exploit the services provided. For instance there is no active competition between office and blue collar workers in athletic events and so forth.

3. RECOMMENDATIONS

(1) Continue to improve the labor climate of the Company. This can be accelerated by establishing and filling the position, Director of Personnel. The incumbent of this position should report to the President of the Company and should be responsible for recommending and coordinating personnel policy for all employees of the Company. All personnel records other than those dealing with fiscal and payroll matters should be maintained in the office of the Director of Personnel.

The individual selected for this position should be equipped for the performance of its duties both by training and experience. To realize the full benefit of such a position the incumbent should have had experience in safety as well as personnel work.

If provided with the assistance of the Industrial Nurse, it is believed that an individual with a well-rounded background can initiate and maintain a personnel program for the Company that will be far more than self-liquidating.

It should be possible to obtain a person with the required ability at a starting salary of somewhere between $7,000 and $7,500 per annum.

(2) After a Director of Personnel has been hired, he should submit a program for improving industrial relations to the Executive Committee for approval. This program should be given consideration and all portions approved by the Committee should receive the complete support of all its members. Target dates should be set for the completion of each project undertaken and these dates should be reviewed periodically by the Committee in order to determine the progress being made.

(3) A definite decision should be made as to the duties, responsibilities and authority to be given to the foremen employed by the Company. Regardless of the decision it should be put in writing in the form of job descriptions for the individual foremen. These job descriptions will protect the Company's interest by spelling out the responsibilities of the foremen and they will protect and aid the foremen in the performance of their duties by spelling out their authority.

(4) Prepare job descriptions for all salaried employees which will show their responsibilities, authority and relationships with superiors and subordinates. Prepare and publish an organization chart showing these relationships. Give the supervisors of salaried employees authority to administer discipline to their subordinates. This authority should be commensurate with the responsibility of the supervisor.

(5) Improve communications between management and worker and between worker and management. This can be accomplished by:

a) Keeping supervisors currently informed regarding all Company policies affecting them and their subordinates.

b) Holding regularly scheduled meetings between top management and supervisors and between top management and labor groups.

c) Providing and maintaining bulletin boards of such a size as to accommodate Company notices and reports in such a manner that they will not become buried under other papers.

d) Providing and maintaining unofficial bulletin boards on which employees may post notices.

e) Installing a suggestion system if a study reveals that the

results obtained from the operation of such a system warrant the expenditure of time and funds involved in the operation of a successful system.

f) Publishing a house organ which will carry news items relating to the Company, its products and employees. Give particular stress to those items which are to the financial interest of the Company and to the individual interest of the employees, and which will add to the employees' faith in the Company's intention to stay in the area. Such a paper would probably be most effective if mailed to the home of the individual workers.

g) Establishing a grievance procedure similar to the one provided for blue collar workers whereby non-supervisory salaried workers can enter grievances without fear of reprisal. Allow this procedure to operate freely.

h) Following the exact grievance procedure outlined in the contracts with the individual locals when handling grievances concerning blue collar workers. In those instances where it becomes necessary to overrule a supervisor's decision, consult with him and endeavor to explain the necessity for doing so.

i) Providing a schedule indicating to salaried employees the conditions of their employment. This schedule should contain statements regarding holidays, vacation benefits, frequency of performance reviews for the purpose of salary adjustments, retirement benefits and other Company benefits.

It should contain also statements as to what the Company expects of its salaried workers and the action that will be taken if performance is below the required standard.

j) Devising merit rating forms to be used in giving a semi-annual merit rating to each employee. This form should be prepared with a view toward achieving the greatest possible objectivity. Ratings should be made by the employee's immediate supervisor. The supervisor should discuss the rating with the employee and offer advice as to how performance can be improved.

(6) Make a study of the positions filled by salaried employees in order to determine whether the salary paid is commensurate with the responsibility of the position, if it is in keeping with the salary paid other workers in the Company performing similar duties or having equivalent responsibility, and if it is equal to or greater than the going rate in the community for like positions. Such a review should be made annually and salary adjustments should be made reflecting its findings, provided an increase is warranted. If a decrease is warranted, it should not be made unless a like decrease is given blue collar workers at the same time.

(7) Make a review of hourly rates paid blue collar workers in order to determine whether they are in keeping with the prevailing hourly rates for similar jobs in this area and, if the difference in hourly rates for the various jobs within the Company reflect the difference in personal attributes required of the individuals filling these various jobs. adjust wages accordingly.

Based on time standards and methods resulting from implementing the recommendations contained in Chapter V, revise the present incentive pay system so that an increase in productivity will result in a commensurate increase in incentive pay. Decrease the size of the group used in determining incentive pay. By reducing the size of the group, for instance on a cost center basis, the incentive pay received by an individual will reflect more nearly his productivity. Disburse incentive pay separately from base pay. This will emphasize to the worker the personal benefits derived from his increased productivity.

(8) Review the shop rules and regulations contained in the union contracts. Rewrite all those that cannot be enforced as now written but which are considered necessary. Eliminate those which are not essential for maintaining discipline.

(9) Prepare written standards which will indicate for every job in the Company, below the senior executive level, the minimum personal attributes an individual must possess to be considered for the job. Adhere to these standards as closely as possible.

(10) After a decision has been made as to the responsibilities to be assigned foremen, as recommended in recommendation (3), a determination should be made as to what training the Company must provide its foremen in order that they can fulfill these responsibilities satisfactorily. Initiate a training program to provide this training. Where possible select well qualified instructors from members of the Company's staff. Tailor these courses to the needs of Rensselaer Valve Company.

In order to provide the best possible instructors and at the same time to enlarge their own abilities, consideration should be given to enrolling the Company's junior and senior executives in an executive development program.

(11) Analyze records of past accidents in order to determine those areas in which improvement can be most readily accomplished. Establish a definite plan to be carried out in improving the accident frequency and severity rates in those areas. Keep accurate records of frequency and severity of accidents sustained by the employees working for each supervisor. Give these records wide publicity in order to encourage safety competition. Post safety standings by number of lost time accidents for each area of supervisory responsibility. Establish safety rules and regulations and enforce them. Endeavor to arrange for pre-employment physical examinations for all new employees regardless of the job for which they are being hired.

(12) Take advantage of every opportunity to emphasize the benefits the Company provides its workers. Keep posted on the benefits provided by other companies in this area. If they are reasonable, freely grant them to your workers.

(13) Make arrangements to keep washrooms clean and bright. Investigate possibility of providing additional shower facilities both to the foundry and machine shop workers.

(14) Initiate practice of giving publicity to all retirements from the Company. Try to arrange for photographs and feature stories in local papers. A letter of appreciation from the President to all retiring workers should create considerable goodwill.

CHAPTER XI

ACCOUNTING

1. FINDINGS

1.1 ORGANIZATION

The Vice President and Treasurer of the Company is in charge of all aspects of accounting and finance. These include:

Credit and collection
Disbursement, including payroll
General accounting
Cost accounting
Cost finding

In addition to the Vice President and Treasurer the staff of the department consists of the following:

Accountant-Supervisor:	Cost accounting and supervision of other members of the department.
Accountant:	Assistant for cost accounting, insurance, credit.
Accountant:	Expense distribution and statistical analysis.
Bookkeeper:	General Ledger and petty cash.
Billing Clerk:	Prepares bills and handles Accounts Receivable.
Receiving Clerk:	Handles Vouchers Payable and all outgoing and incoming checks. Assists in Accounts Receivable.
Payroll Clerk:	Prepares payroll manually.
Clerk-Typist.	

Timekeepers (4): One of these is in the Big Machine Shop, one is in the Foundry and the remaining two are in the Accounting Department where they total job cards and compute incentive rates for entire plant. The timekeepers in the

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foundry and machine shop assist the Production Foremen in addition to their timekeeping duties.

1.2 SCOPE

This investigation was limited to the cost accounting and cost finding functions of the department. General accounting was touched on insofar as it and cost accounting are related; credit, collection and disbursement were not investigated in any way.

The cost accounting and finding functions may be considered to consist of three separate activities: (i) the actual process of cost accounting on the books of the Company; (ii) the process of determining the cost of production of each type of standard valve and of each large or special valve; and (iii) statistical analysis of numerous costs of operation which are used as the basis of various reports to management in order that management may make decisions regarding operations. These three activities are, of course, closely related; some of the results of one activity are used in one or both of the others, but in general they are separate and distinct. All of them, however, depend on the expense distribution system; accordingly this system will be described first. Its relation to all of the activities of cost accounting and cost finding will be apparent.

1.3 EXPENSE DISTRIBUTION

For purposes of cost accounting the entire manufacturing operations of the Company are divided into ten production cost centers and eighteen service cost centers. All costs of manufacturing are distributed to these cost centers. Table I lists the productive and service cost

centers. The expenses of each cost center are subdivided according to purpose or type of expense; e.g., direct labor, indirect labor, supplies, and so forth. These may be seen in the report, explained below, which summarizes these expenses.

The actual distribution of expense into types and into cost centers is accomplished monthly by a semi-automatic system, utilizing the services of the IBM service center in Albany. The Company's part of this procedure is limited to the preparation of "Coding Sheets" (11.1). On these sheets each voucher is listed on one line together with the purpose and cost center to be charged. A separate set of coding sheets (11.2) is prepared for non-voucher expense such as payroll, taxes, insurance, depreciation, and so forth. (Raw material is not included as expense.) From these sheets the service center prepares, by punch card machines, summary sheets which indicate the total expense of each type charged to each cost center. (The voucher coding sheets also serve as information from which the entire Accounts Payable section of the General Ledger is operated.)

Using these summary sheets the accountant then distributes the service center costs to the ten productive cost centers. The basis of distribution is given in the appendix (11.3). As can be seen, some of these bases are estimates prepared with the aid of the supervisor of the service center involved. It should be noted that some of the direct expenses of the production cost centers, that is those not apportioned from the service centers, are themselves apportionments; e.g., depreciation. It should be noted also that none of the service center expense is apportioned to the Core Department since the expenses of this de-

partment are going to be apportioned later to the molding departments.

The end product of this apportionment process is a report to management entitled "Analysis of Departmental Costs" (11.4). This report consists of one sheet for each cost center, giving the departmental expense of each type, direct and apportioned, for the current and previous months and the total to date for the current and previous years. In addition an overhead rate per direct labor dollar is computed. This is the total cost of the department less direct labor, divided by the cost of direct labor.

The costs obtained by the system are obviously the principal source of all cost figures and the report is management's principal source of information as to theexpense of operating the factory.

The Analysis of Departmental Costs shown in the appendix (11.4) shows the costs of all service cost centers being distributed to the productive cost centers. This was the method used at the beginning of the investigation. In late March, however, it was decided that, retroactive to 1 January 1954, the expenses of certain service cost centers would no longer be distributed to the productive cost centers but would be charged to general and administrative expense. This serves to charge these costs as period costs rather than including them in the cost of goods sold and in inventory. The cost centers no longer distributed are:

542 Product
543 Industrial Engineering
548 Supervisory Training
549 Research and Development
581 Purchasing
582 Receiving and Shipping
591 Cost Accounting, Timekeeping and Payroll
593 Office Service

TABLE I

Cost Center Number	Name
	PRODUCTION COST CENTERS
	Foundry
451	Line Molding
452	Floor Molding
453	Brass Foundry
454	Chip and Clean
462	Melting
463	Core
	Machine Shop
455	Big Machine Shop
456	Old Machine Shop
457	Upstairs Machine Shop
458	Hydrant Department
	SERVICE COST CENTERS
459	Yard (Machine Shop Yard)
460	Tool Crib
461	Pattern Shop
481	Plant & Office Maintenance
541	Inspection
542	Product Engineering
543	Industrial Engineering
545	Maintenance Shop
547	Boiler Room
548	Supervisory Training
549	Research & Development
551	Planning,Scheduling,Dispatching
553	Finished Parts Store
554	Finished Goods Store
581	Purchasing
582	Receiving and Shipping
591	Cost Acctg.,Timekpg.,Payroll
593	Office Service

All of the records and reports for the year 1954 were recomputed to reflect this change.

1.4 ACCOUNTING ON THE BOOKS OF THE COMPANY

The cost accounting system on the books of the Company is a very simple process. In fact it is not a cost accounting system at all; it is not connected in any way with the determination of the cost of any valve nor of all valves. It serves merely to keep an approximate set of books, such as may be kept by a small mercantile establishment, so that a trial balance or a balance sheet may be prepared at the end of any month to give a very rough approximation of the Company's position. What should be its end product, the Cost of Goods Sold, is purely an estimate. No meaningful figure can be obtained until a physical inventory is taken at the end of the year.

Figure XI-1 shows the operation of the system with an indication of how the various entries are prepared monthly. The figures on the lines and in the following paragraphs are the numbers of the journal entries that are made to enter the books. The start of the system is the expense distribution system mentioned previously. As each expense is entered into the system and entry is made in the Expense Control Account (23). The total monthly expense derived from the distribution system, referred to on the books as labor plus burden, is entered in the Expense Clearance Account, which must balance the Expense Control Account, and is entered also in the two Work in Progress (WIP) Accounts (67). The total raw material used is transferred from the appropriate raw material account to the Foundry WIP (60). Then this account is re-

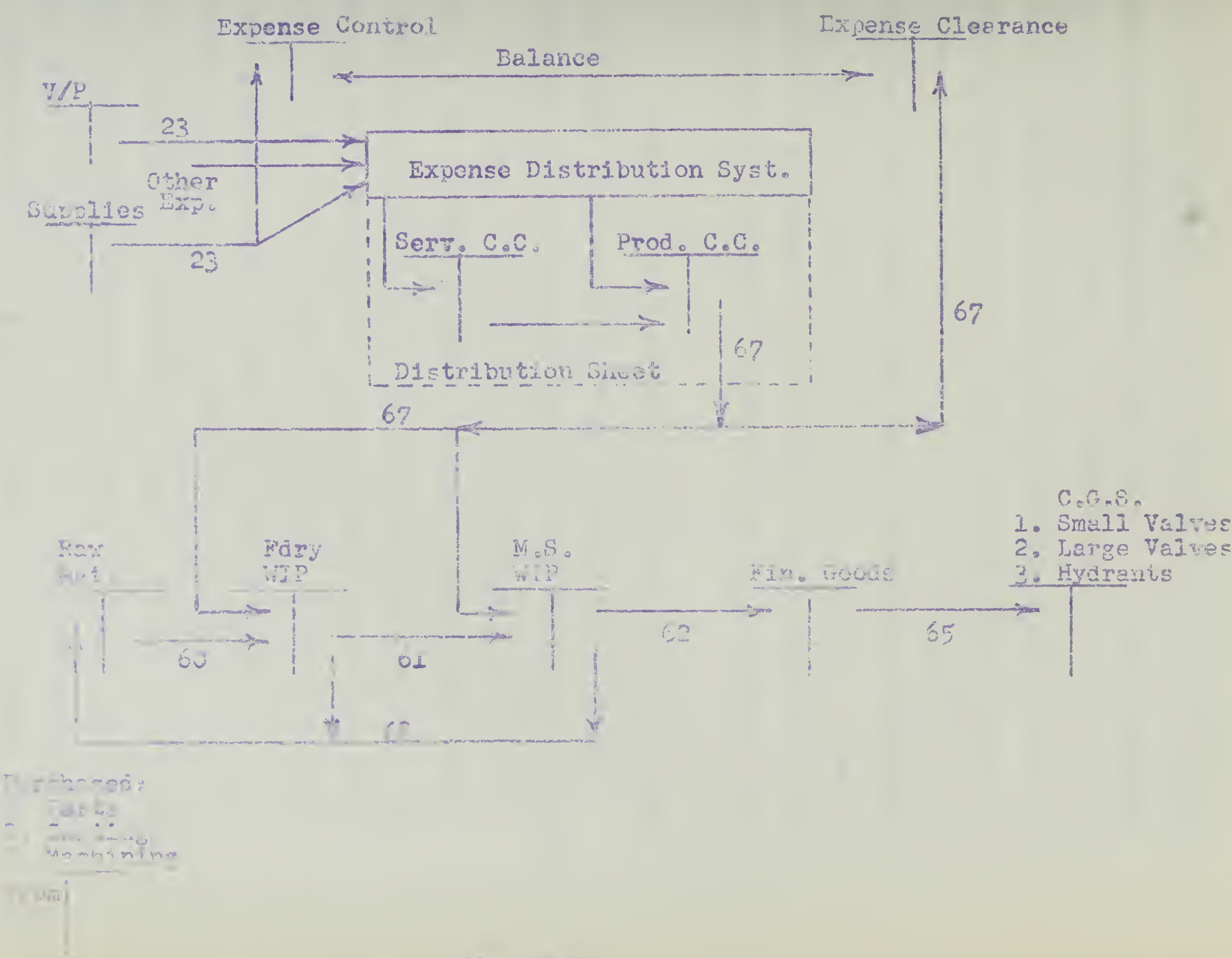
Expense Control
Expense Clearance
Balance
V/P
23
Other Exp.
Supplies
23
Expense Distribution Syst.
Serv. C.C.
Prod. C.C.
67
Distribution Sheet
67
67
Fdry WIP
M.S. WIP
Fin. Goods
C.G.S.
1. Small Valves
2. Large Valves
3. Hydrants
60
61
62
65

Fig. VI-3

lieved of the total value of foundry production (61), obtained by multiplying total weight in pounds by the cost per pound of good castings. This is the only link between cost determination and the books of the Company. The method of obtaining total production and the cost per pound will be explained below. However, since the cost per pound is obtained in effect by dividing total cost by total good production, it readily can be seen that this entry removes essentially all the debit in the Foundry WIP account. All of the foundry production is entered as a debit to the Machine Shop WIP; hence the entire inventory of castings in the yard and basement is carried on the books as Machine Shop WIP.

The value of the scrap produced by the foundry and that found in the machine shops is credited to the respective WIP account and charged back to the Raw Material Account at the market value of Scrap (68).

The Machine Shop WIP account has debited to it now all production of the foundry plus its own expense. The next logical step is to credit this account with the value of finished goods produced. This cannot be done, however, since its value is not known. Instead the remainder of the process is carried out in reverse. The Finished Goods Account is credited first with the Cost of Goods Sold (65). This is obtained by multiplying the net sales for the month by the historical ratio between Cost of Goods Sold and Net Sales. The Company used the figures from the last calendar year to obtain this ratio. Separate accounts and ratios are used for small valves, large valves and hydrants. Of course the Cost of Goods Sold for the entire year is accurate since

it is based on a physical inventory taken once a year of the entire plant including finished goods and work in progress. However, its relation to the Cost of Goods Sold for a particular month is entirely arbitrary.

Now that the Cost of Goods Sold has been entered the WIP account can be relieved of the proper amount (62). This is merely the amount necessary in order to make the value of the finished goods inventory on the books agree with the value of the finished goods obtained by a physical inventory of finished goods taken at the end of the month. But again a complication enters. The physical inventory merely shows the number of each type valve in stock; it shows nothing about its cost of production. So again resort is had to history. The inventory is priced at list price in the zone in which actually located. Then this total cost is divided by a historical ratio between gross sales and net sales. (Net sales are gross sales less freight, adjustments and discounts.) This gives an estimate of net sales value of the inventory. This is treated then like Cost of Goods Sold; i.e., multiplied by the historical ratio between cost of goods sold and net sales. The resulting figure is an estimate of the cost value of the inventory. Thus the last entry (62) is obtained by adding the Cost of Goods Sold and the inventory value obtained as explained above and subtracting the value of the inventory obtained at the beginning of the month. This entry completes the system. It must not be thought, however, that the WIP accounts actually show even a rough estimate of the WIP. Note on the left of the diagram that there are three purchased goods accounts. These are debited each month but never are credited until a physical

inventory is taken at the end of the year. Since these accounts never are credited, the value of purchased goods never is debited to WIP. An estimate of their value, however, is removed from the WIP account in J.E. 62 since the value assigned to the Cost of Goods Sold and inventory change obviously includes purchased goods. Accordingly the balances of the WIP accounts are too small and the balances of the three purchased accounts are too large by the value of the purchased goods used. An estimate of the WIP for monthly reports is obtained by adding the purchased accounts and the WIP accounts.

Another peculiarity exists in the WIP accounts. For some reason connected with past history the Machine Shop WIP account which should show a large debit balance, since it includes the tremendous stock of castings in the yard and basement, actually shows a continuous credit balance. Thus its balance must be subtracted from the sum of the other accounts mentioned above in order to obtain an estimate of WIP. This condition could be remedied by some sort of adjusting entry, but since the figures are meaningless no such entry has been made.

It is only fair to mention at this point that the Company recognizes the shortcomings of this system and expects to change it shortly. As will be seen below, a system is now in effect that will give a good estimate of the actual cost of production of each type small valve and each order of large valves. Starting in March 1954 the Company expects to use these values as cost of goods sold. Hence the monthly total of Cost of Goods Sold will be obtained by actually pricing the total sales.

1.5 COST DETERMINATION - METAL AT THE SPOUT

The determination of the costs of production of valves and hydrants may be considered to be similar to a process cost accounting system, though the Company actually does not use such a system on the books of the Company. In such a system the cost of a valve may be separated into four separate costs: (a) the cost of the metal as poured into the mold, obtained by multiplying the weight of the casting by a cost per pound of metal at the spout; (b) the cost of molding and core-making; (c) the cost of chipping and cleaning; and (d) the cost of machining and assembly. The cost of metal at the spout is a basic cost which must be computed before any other costing procedure. The procedure used for iron will be explained; that for brass is very similar.

The basis for the determination of the cost of metal at the spout is three reports received from the foundry. The first of these is the Daily Raw Materials Report (11.5). It shows the amount per charge and total for the day of each of the several raw materials charged into the cupola. In addition it shows the weight of the cupola drop (always assumed to be three hundred pounds), the actual weight of gates and risers recovered, and the actual weight of pig bed poured to empty the cupola.

The second report received is the Foundry Production Schedule (11.6). This is actually a report of foundry production prepared after the production is completed. It shows the quantity and description of all castings poured, together with the standard and actual molding hours and total actual and standard foundry labor hours.

The third report received is the Foundry Delivery Report (11.7), commonly referred to as the "Whiz" ticket since it is prepared on a multiple form machine. One of these tickets is prepared for each lot of castings delivered by the foundry, chipped and cleaned, to storage or to the machine shop. A separate ticket is prepared for each lot of scrap castings returned to the yard.

The total weight of castings poured is obtained by totaling the weights from the Foundry Production Schedule. The total of scrap reported each day is obtained by totaling the scrap tickets. This total is then subtracted from the total production to give total weight of good castings produced each day. This is entered on the raw materials report, together with the scrap weight, and the daily percentage yield is computed. All metal not accounted for is considered metal loss.

No attempt ismade to correlate the scrap report with the Production Schedule. Since a considerable delay may ensue between production, discovery and reporting of scrap, it is apparent that the daily figures are not of much value. However, the weekly and monthly totals are probably reasonably correct.

The total weights of good castings produced daily and the weights of metal charged are totaled weekly and monthly to obtain total production of good castings and total charge.

The cost of metal per pound of good castings is obtained then by dividing the value of all material charged into the cupola during the month by the weight of good castings produced.

The cost of metal at the spout is obtained by dividing the total cost of the cupola for the month, including metal, labor and burden,

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by the pounds of good castings produced. This is accomplished at the end of the month, using the total metal cost plus the total expense for melting obtained from the expense distribution system.

The Foundry delivery tickets (11.7) mentioned above are totaled weekly and monthly, by molding department producing the mold, to give the total of castings delivered by the Foundry. This is used for the journal entry transferring WIP from foundry to machine shop and also for statistical analysis to be mentioned below.

1.6 COST DETERMINATION - SMALL VALVES

After the cost of metal at the spout is determined the actual costing of valves may be accomplished. This is done in two separate ways - one for small valves and hydrants, the "Standard Line", and the other for large valves, produced on special order. The method for small valves may be summarized as follows:

a) For each type valve the total weight of castings, the total standard hours of molding time required in each molding or core-making department and the total standard hours required in each machine shop are determined.

b) For each department there is determined a Composite Rate per Direct Labor Hour. This is obtained from the Monthly Analysis of Departmental Expense and the total hours worked. This rate is computed monthly and a running average for the year to date (or since the last change of basic labor rate) is kept. This Composite Rate is then adjusted for the ratio between actual and standard hours for each month.

c) The weight of metal required is multiplied by the cost of metal at the spout per pound to obtain the metal cost of the valve.

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in each department are multiplied by the proper composite rate mentioned above to get the total cost, and these are added for each department. This is added to the cost of metal and the cost of purchased parts to obtain the cost of the valve.

At the present time the cost of production of most of the standard valves and hydrants have been computed in the manner described above. These values have been revised quarterly and are used solely as a source of information as to cost and to determine pricing policy. As mentioned, the use of these costs to determine the Cost of Goods Sold on the books of the Company is expected to begin in March 1954.

Mr. John [illegible], Cost Accountant for the Company, has prepared detailed instructions for this process. These instructions follow, quoted directly.

"COST PROCEDURE"

"SMALL VALVES & HYDRANTS"

"The procedure for costing small valves and hydrants is outlined below. Such detail papers as are considered necessary for a clear explanation are attached. They include:

(I) 1. Bill of Material
2. Hour and Weight Summary
3. Cost Summary

(II) 1. Evaluation of Composite Rate
2. Schedule of Departmental and Metal Costs.

PROCEDURE:

"Bill of Material (11.8) - A bill of material is obtained from the engineering department for the sub-assembly or valve to be costed.

"Hour and Weight Summary (Right half of 11.8) - Parts as shown on the Bill of Material are transcribed to the Hour and Weight Summary. To the right of each part are listed, in the appropriate column, the unit weight, the hours or fractional hours (standard) for machining one unit, the hours or fractional hours (standard) for molding and coremaking

one unit. Unit weights and unit hours are then multiplied by the number of units required in one valve or sub-assembly and the total weight and/or hours required for each part are entered under the appropriate departmental designation.

"Cost of purchased parts are entered in a "Purchased" column.

"The total hours and/or weight and the total value of the purchased items are then posted to the Cost Summary.

"Cost Summary (11.9) - The cost summary evaluates the spout cost of metalsincluded in the valve, the foundry labor and burden molding value of the valve, the machine shop labor and burden value of the valve, a scrap loss allowance for each division - foundry and machine shop, and a value of the purchased material included in the valve.

"Cost per Pound at Spout - Metal cost plus melting cost divided by total pounds of good production.

"Composite Rate - Total departmental expense including all labor and burden divided by total direct labor hours worked. Accumulation of departmental expense and direct labor hours worked are made for identical periods of time.

"Allowance for Scrap and Spoilage - The allowance made in Departments 451 and 452 is based on the prior month's experience. The allowance made for Department 453 is estimated. The allowance made in 463 follows the allowance made for Department 451, 452, or 453, depending on the molding location.

"Included in the machine shop scrap allowance is a contingency for such "down" or non-productive hours not included in the standard. An example of such "down" time would be "oiling machine".

"Chip and Clean Cost per Pound:- Total Expense in the Chip and Clean Department divided by the total pounds cleaned.

"Purchased Material - The value of purchased material is at the most current price of the item costed.

"General and Administrative Expense:- The ratio of sales and general administrative expense to cost of sales as shown cumulatively on the most current Profit and Loss Statement multiplied by the prime cost of the valve.

"EVALUATION OF COMPOSITE RATES:

"Perhaps the best explanation can be made by a step-by-step review of the form used in the computation of the composite rate. (11.10, 11.11).

"Line #1. Monthly Analysis of Departmental Costs - The amount stated includes the value of all labor and burden in that department, plus the value of the labor and burden of a portion of those centers servicing that department.

"Lines #2 & 3. Maintenance Labor Reduction and Adjustment - Maintenance labor, included in total in department #457, is an expense of all machine shop departments. It is included in Department #457 because of physical location. To allocate the expense to all departments steps shown in lines 2 and 3 are made.

"Lines 6 through 14 are now obsolete, labor hours being adjusted on original papers.

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COST PROCEDURE - SMALL VALVES & HYDRANTS (Cont'd.) (3)

"Line #15. Departmental Expense as Adjusted - The amount shown here is the sum of the expense shown in Line #1, plus or minus the variances on lines 2 and 3.

"Line #16. Composte Rate per Hour - is determined by dividing into the adjusted departmental expense shown in Line #15 by the Direct Labor Hours for the department as computed under "Adjustment of Direct Labor Hours".

"The foundry is treated in a similar manner except that a "Maintenance Labor" adjustment is not required and the allocation of Department #463 (Core Department) is removed from each department and returned to its proper production center.

"DEPARTMENTAL AND METAL COSTS:

"The primary purpose of this form (11.12) is to show the effect of performance, over or under standard, on the composite rate. Actually the performance rate should be multiplied by the standard hour content of the item costed. However, inasmuch as the extended effect of standard hours multiplied by the composite rate would be the same should either the standard hours or the composite rate be reduced by the performance factor, the composite rate is reduced. This step requires but one factoring computation eliminating the factoring of standard hours on each cost summary prepared.

"The base hourly cost shown on the form is the cumulative average composite rate as accumulated from the first of the year. This cumulative procedure is maintained until a change in base rate requires that a new cumulative series be begun.

"The performance reduction factor is the average performance computed for the month in each department."

1.7 COST DETERMINATION - LARGE VALVES

The determination of the cost of large valves is similar to that of small valves. The only difference is in the handling of machine shop time. In the Big Machine Shop a record is kept of the actual time of each operation on each part. Thus the actual time for each part may be determined. To determine the cost of machining the valve the total time for all parts is multiplied by the composite rate of the Big Machine Shop and this is the total machining cost. The foundry costs and purchased parts, as well as any small parts made in the small machine shops, are treated in the same manner as is done for small valves, and the total cost of the valve determined in the same manner, using the hour and Weight Summary posted from the Bill of Material and the Cost Summary.

Since each valve has many parts, each of which requires several machining operations, and since the Big Machine Shop works on many valves simultaneously, the task of determining the actual hours worked on each valve is not easy. The Company has devised a system to accomplish this and, at the same time, determine each operator's daily production and hence his incentive rating. This involves the use of a Job Card (11.13) which is prepared in duplicate, one copy being used for job costing and the other serving to record operator's performance. In addition the Job Card serves the Scheduling Department as a Machine Loading Order.

The Job Card is prepared by the Timekeeper in the Big Machine Shop, an employee of the Accounting Department. When he receives the monthly schedule of valves to be produced in the shop, he makes out a

card for each operation on each part of each valve to be produced. Machine production is ordered merely by placingthe proper card in a rack at each machine, usually placing three or four cards, in order of work to be performed, at each machine.

The actual time of beginning and ending each job and any "down time" is recorded on the card by the Timekeeper, by time clock or by estimate, and the cards are picked up at the close of each day. If a job is not finished, the card is picked up, the portion complete recorded, and a new card prepared for the remainder of the job and left at the machine. Both copies of the card are forwarded to the Accounting Department where one is filed by operator to serve as his performance record. The other copy is used for costing. The method by which the cost card is kept and recorded has been described also by Mr. Solar, and is quoted, together with a chart which shows the flow of the card and its relationship to the costing procedure. (11.14)

"JOB COST - FILING AND COMPUTING PROCEDURE

" (I) With the Production Schedule as a reference, procure Bills of Material for jobs to be run.

" (II) Using the Bill of Material as the source pull a pre-marked file tab for each part.

"(III) Place the tabs selected in step (II) in the file of Jobs in Process. Tabs will serve as a guide to daily filing of job cards and as a check to see that job cards are present for all parts required. Immediately preceding the group of tab cards representing one job number place an off-color tab denoting that job number.

" (IV) Using the Bill of Material as a source, post a part list on the "Hour and Weight Summary". Posting not required when "Add" sheet is attached to Bill of Material.

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[illegible]

[illegible]

[illegible]

[illegible]

For foundry summary of hours and weights standards shall be used. Extensions and summaries for the foundry will be completed for one valve only. On jobs requiring more than one valve the totals derived in each Departmental or weight column will be multiplied by the number of valves required for the job. One unit extensions and column summaries are required so that the totals derived for that unit may be used as a base for all future valves costed on that particular Bill of Material.

" (V) On notice of completion of a job pull the tab cards and the job cards for that job from the "Jobs in Process" file. Check to see that all parts required, and their individual operations, are accounted for by job cards.

Summarize the hours by part and post to the hour and weight summary, carefully indicating "Set Up", "Oiling" & "Other" hours.

Those operations done in Departments other than (455) will be charged on the hour and weight summary sheet at standard hours factored by the performance of the fabricating Department.

" (VI) Remove tab cards and return to tab card file. Identify job cards by Job Number and file in "Jobs Completed".

"(VII) Post Hour & Weight Summary Totals to "Cost Summary Sheet". "

1.8 STATISTICAL ANALYSIS

The major activity of the cost accountant is the statistical analysis of the Company's operations. The results of this analysis are presented in numerous reports to management. This investigation dealt only with those reports which are concerned with cost of operation; numerous other reports concerning sales, finance and general bookkeeping were not investigated. The statistical analysis of costs will be described by describing the various reports to management. No significance should be attached to the order in which the reports are presented.

Daily Analysis Foundry Scrap Reported - Iron and Brass (11.15)

This report is prepared daily from the foundry scrap tickets mentioned above. The report gives the description, size, list number,

ticket number, and the molding unit for each piece or pieces of scrap, together with the number of pieces, the unit weight and the total weight. A very brief reason for the occurrence of each piece is given also. These are totaled for iron and brass separately to give the total day's scrap reported by the foundry.

Monthly Analysis Foundry Scrap Reported (11.16)

This report presents the monthly totals of iron and brass scrap reported by the foundry, and estimates the cost of the scrap. In making this estimate it is assumed that 85% of the line scrap reported is discovered at shakeout, the remaining being discovered during or after chip and clean.

Monthly Analysis Machine Shop Scrap (11.17)

This report presents the monthly totals, by machine shop department, of the scrap discovered in the machine shops as well as that caused by machine shop errors.

Analysis of Foundry Production (11.18)

This report is prepared weekly. For floor molding it gives a description of each casting produced each day, together with its weight and the total day's weight. For line molding and brass it merely presents the total week's production in pounds and the weight of scrap reported. For line molding this data is presented by molding units. A grand total of good castings and scrap from the foundry is presented also.

Monthly Analysis - Iron & Brass Chipped and Cleaned (11.19)

This report presents the weekly totals ofthe weights of castings chipped and cleaned, broken down into the various producing units.

Weekly Production and Cost Analysis - Foundry (11.20)

This is one of the most important and basic reports prepared by the department. A separate page is devoted to each of the five departments or cost centers of the foundry, and the data for each week takes only one line. The report is prepared each week by adding the line for that week to the "ditto" master and then reproducing so that each week's report includes all theprevious weeks', in a semi-annual period. The report of operation of the various departments is of slightly different form, but an examination of each of them shows that the principal result of the report is the cost per pound. In the melting department the cost per pound of metal at the spout is determined, while in the Chip and Clean report the cost of chipping and cleaning per pound is shown. Then in the molding departments these costs are added to the molding and coremaking cost per pound to determine the overall cost per pound of chipped and cleaned castings produced by each of the molding methods. It should be noted that the departmental expenses are not known each week; therefore the cost of operation is based on the direct labor costs from the payroll and the overhead rate determined for the last month on the Analysis of Departmental Costs previously mentioned.

Summary of Operations (11.21)

This report is prepared at the end of each four-week period and is summarized at the end of each 26-week period and again at the end of the year. It is an overall report in very general terms, intended for top management. The report is divided into three sections. In the first section, Payroll, the total regular and overtime hours and pay for each department for the period is presented. In the second section, Production,

is presented the overall value of finished goods produced and the total weight of good castings and scrap produced by the foundry. In addition appears such pertinent data as the labor cost per pound of castings, pounds per man-hour, and the like. The third section is entitled "Shipments & Billings", and shows the total shipments in pounds and the total billings for the period. A grand average of selling price per pound produced and per pound shipped is presented also.

Weekly Labor Analysis (11.22)

This report is primarily part of the Group Incentive Payroll system which has been described in another section of this report. It is presented in the same manner as the Weekly Production and Cost Analysis; that is, each department has one page and each week's report is added on a separate line. The headings of the columns are self-explanatory.

2. APPRAISAL

2.1 INTRODUCTION

The cost accounting and cost finding functions of the Company may be said to be in a state of transition. Prior to the time that the present Treasurer and his chief assistant became associated with the Company, about three years ago, there were essentially no cost accounting nor cost finding functions performed. Upon their becoming associated with the Company they embarked on a long-term program to install a complete, modern, standard-cost system. They have stated that this installation process will take from five to eight years, of which three have passed. This appraisal, then, is a measure of their progress towards their goal, and should not be considered as criticism of the present department.

Even though a casual reading of the description of the present procedures may make it appear that only the most rudimentary of cost finding systems is now in effect, the actual groundwork for a complete system has been laid. A great amount of work remains to be accomplished before the complete system is installed, but the progress of the past three years is considered highly significant.

2.2 PROCEDURES IN EFFECT

The procedures described above may be summarized as follows:

a) An expense distribution system is presently in operation. This system gives a reasonably accurate picture of the expenses of each department, or cost center, although the basis of distribution of some of the Service Cost Centers to the Productive Cost Centers is somewhat

arbitrary. It was noted that this basis of distribution had apparently not been reviewed for about two years.

b) A system for determining the cost of each type of standard valve or hydrant and of each order of non-standard valves is in operation. This system determines the cost of each valve with acceptable accuracy for its present purpose; i.e., to determine pricing policy and to cost the valves in the Inventory and Cost of Goods Sold accounts. It is neither an actual cost nor a standard cost, but a combination of the two, and is not useful for a true cost accounting or cost control system. The procedure for determining the costs, however, could be adapted easily to a standard cost system.

c) The various statistical analyses provide useful information to management, but in a form that is not too easily assimilated or used by management. Again, however, the systems in effect form the groundwork for a true cost accounting and control system, and the procedures for collecting the data from the factory and certain of the basic computations can be adapted to a standard cost system.

2.3 SHORTCOMINGS

It is readily apparent from the description given under FINDINGS that:

a) There is no cost accounting system on the books of the Company.

b) Although the actual cost of operating each cost center is known, no standard cost is known; in other words, no one knows how much it should cost to operate each department.

c) Similarly, although the cost of producing a valve is known, no one knows how much it should cost to produce a valve.

3. RECOMMENDATIONS

3.1 INTRODUCTION

As stated above, the Cost Accounting and Cost Control systems of the Company are in a state of transition. Inasmuch as none of the procedures now in effect will be utilized in its present form in the ultimate system, it seems futile to make specific recommendations regarding these procedures. Instead this section will take the form of a description of a complete cost accounting and cost control system which, it is felt, could be employed by the Company. Apparently neither the Treasurer nor his principal assistant has reduced to writing the actual system towards which they are working. The system to be described, although probably not the ultimate adopted by the Company, will at least serve as a model for planning purposes, and it is recommended that as each new procedure is adopted it be examined critically to see that it fits in with the ultimate system described.

3.2 ASSUMPTIONS

Before the complete system can be installed, certain steps not directly connected with the Accounting Department must have been accomplished. These have been described elsewhere in this report. For the purposes of describing the accounting system, then, the following assumptions are made.

a) That the industrial relations of the Company have been improved to such an extent that an adequate incentive payment plan, based on productive standard hours, has been designed and is in operation. If

a straight piecework incentive system is adopted, the accounting system will be somewhat different from that to be described.

b) That a standard or acceptable level of scrap has been determined.

c) That production standard times have been determined for all operations on all repetitively produced valve and hydrant parts and for all assembly operations.

d) That a complete numerical parts list for all valves and hydrants has been compiled. All drawings, lists and so forth should use this numerical system, and it should appear on all patterns and castings.

e) That a numerical system of designating all valves and hydrants has been devised and is in use. This system must indicate all variations of valves and hydrants which might affect cost.

Furthermore, it is considered that because of the very large number of different products no completely adequate cost system can be installed without a Machine Accounting (punch card tabulating) System. Accordingly such a system is assumed in the accounting system to be described, although the system is presented without specific mention of the machine system. It is understood that installation of a machine system is contemplated by the Department for some time in the future.

3.3 STANDARD ACTIVITY LEVEL

For each Productive Cost Center and for the factory as a whole there must be determined a standard activity level. For all productive cost centers other than Melting and Pouring this will be in the form of productive standard hours per year. For Melting and Pouring this will

be in pounds of metal poured per year. The monthly activity levels will be determined from the yearly levels in accordance with the number of days in each accounting month. For each Service Cost Center the standard activity level will be the plantwide level.

3.4 STANDARD EXPENSE SCHEDULE

For each Cost Center there must be determined a standard expense schedule based on the standard activity level, showing all controllable and fixed costs. This must be determined in consultation with the foreman of each center. Since the expense distribution system has been in effect for several years, the Analysis of Departmental Costs for the past several years can serve as a guide in preparing these schedules.

The standard expenses must make allowances for the standard quantity of scrap by increasing the variable costs by the proper amount and by carefully determining that the fixed costs are sufficient to cover the costs of producing the standard activity level plus the scrap.

3.5 COMPOSITE RATE

For each Productive Cost Center a Composite Rate per Productive Standard Hour (or per Pound) then can be determined. This is merely the total of the Expense Schedule divided by the Standard Activity Level. It should be noted that shakeout is considered part of the melting and pouring cost center. Consequently the cost per pound of this center includes shakeout costs.

3.6 STANDARD COSTS

Every casting must then be costed. Its cost is determined by

adding the standard cost of the metal, including shakeout, to the products of standard hours and composite rates of each of the departments involved in the manufacture of the casting. This will usually be a molding department, perhaps the coremaking department, and the chip and clean department. It should be noted that this means that there must be determined a standard time for chipping and cleaning each casting. This is perhaps the most difficult of the standard times to be determined.

The standard cost for each valve and hydrant must be determined then in a similar manner, using the costs of all the castings plus the machining and assembly costs determined from the composite rates of the shop involved, and the costs of the purchased parts.

3.7 VARIANCES

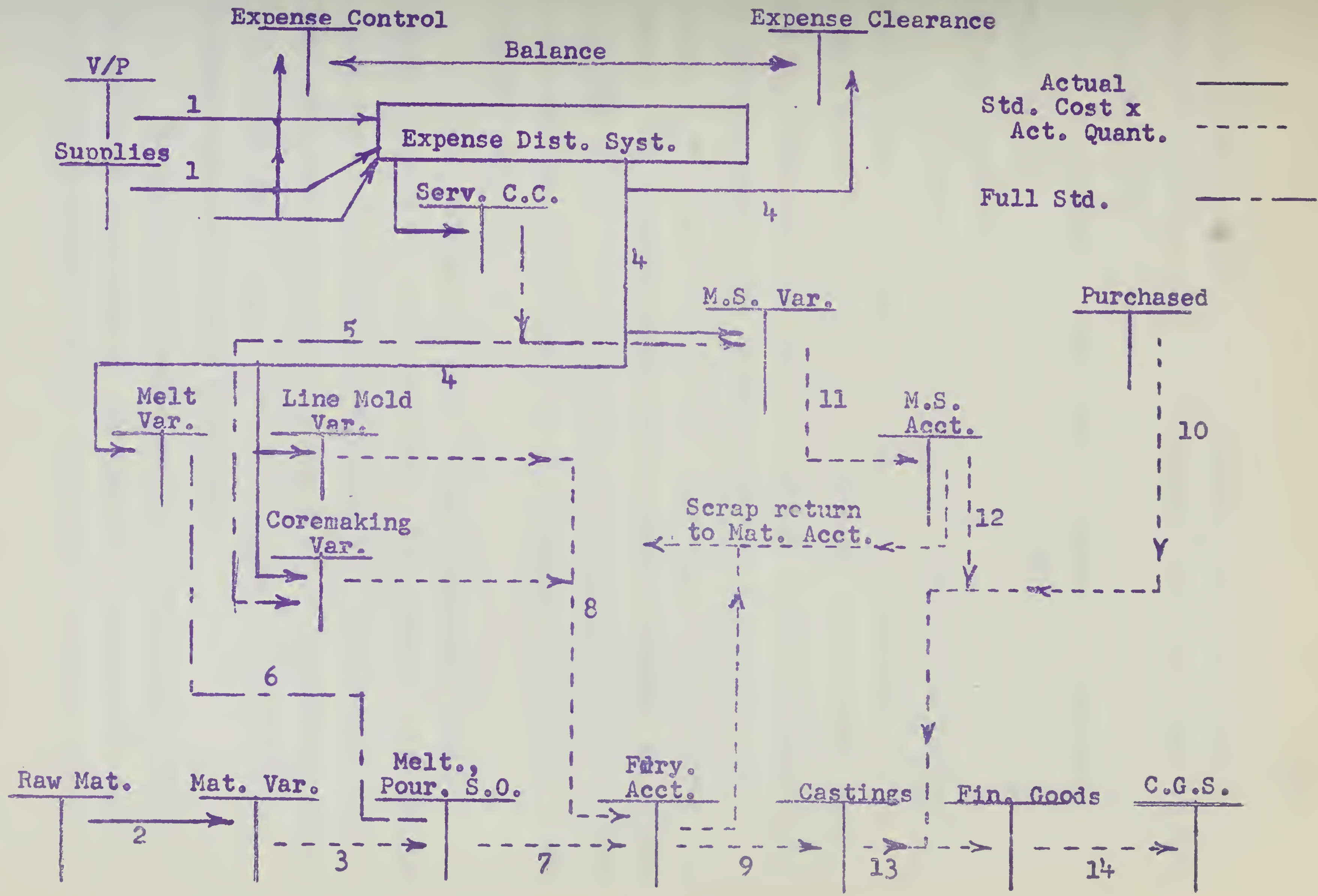
For each accounting period each Cost Center must be furnished with three separate variances which show its departure from standard. These will be (a) the activity variance which indicates the departure from standard due to a difference in activity between actual and planned, (b) the expense variance which indicates the departure from standard expense, corrected for the effect of activity, and (c) the efficiency variance which indicates the effect of varying efficiency. It is these variances, together with the standard expense schedules, that form the cost control system. They may be broken down into variances of each type of expense, for closer control. The method of determining the variances, partially on the books of the Company and partially by statistical analysis, will be explained below.

3.8 OPERATION OF THE SYSTEM

The operation of the system and the statistical analysis necessary to determine the variances may be explained best by following the records of one type of valves, the standard, through the entire process. Figure XI-2 shows the flow of data through the accounts. The figures in the following description refer to the numbered lines of the diagram. A similar set of accounts must be used for the shops not involved in the standard valves. It is not suggested that all of these accounts actually appear on the general ledger; control accounts, summarizing the various accounts, may be used instead.

The system starts with the entry of expenses, voucher and non-voucher, into the expense distribution system in the same manner as at present. At the same time the actual cost of material received is entered (1) from vouchers payable into the Material account. The actual cost of all material used, obtained from the Daily Raw Materials Report, is credited to the Materials and debited to the Materials Variance account (2). The standard cost, equal to the standard price multiplied by the same actual quantity, from the Daily Raw Materials Report, is credited to the Material Variance account and debited to the Melting, Pouring and Shakeout account (3). The balance in the Variance account is the Material Variance for the period.

The actual expenses of each Cost Center are obtained from the Expense Distribution system and debited (4) to the proper departmental variance account. Then the Service Cost Center accounts are credited with the standard expense of each department (5) which is distributed by predetermined percentages to the Productive Cost Centers. Since these



Expense Control
Expense Clearance
Balance
V/P
Supplies
1
1
Expense Dist. Syst.
Serv. C.C.
4
4
4
5
Actual
Std. Cost x
Act. Quant.
Full Std.
M.S. Var.
Purchased
Melt
Var.
Line Mold
Var.
Coremaking
Var.
11
M.S.
Acct.
10
12
Scrap return
to Mat. Acct.
8
6
Raw Mat.
Mat. Var.
Melt.,
Pour. S.O.
Fdry.
Acct.
Castings
Fin. Goods
C.G.S.
2
3
7
9
13
14

Fig. XI-2

are full standard costs, each of the entries designated (5) remains constant from month to month. The balance in each Service Center account is the variance for the center.

The Melting Variance account is credited with the standard melting expense for the month (6), leaving as a balance the expense variation for the month.

The Melting, Pouring and Shakeout account now has debited to it all the standard expenses of melting, pouring and shakeout. It is credited with (7) the standard cost of the metal in the castings poured, from the Foundry Schedule. This is the weight of castings multiplied by the standard cost per pound of metal, poured and shaken out. The balance in the account is the activity variance plus the efficiency variance. The activity variance may be computed by obtaining the difference between actual and budgeted pouring, and multiplying by the standard cost of metal poured and shaken out. The remainder of the balance is the efficiency variance.

The amount credited to the Melting, Pouring and Shakeout account is debited to the Foundry account. Also debited to this account are the values of the molding and coremaking (8). These are the actual direct labor hours (from payroll) of each of these departments multiplied by the proper composite rate. Since these already contain allowances for scrap, no further allowance is necessary.

The Molding and Coremaking accounts now have been relieved of the value of the work performed. The balance is the sum of the expense variance and the activity variance. The activity variance is obtained

by multiplying the composite rate by the difference between actual and budgeted hours, and the remainder of the balance is the expense variation.

The Foundry account then is credited with the standard cost of the castings delivered (9). This requires that the Foundry Delivery (Whiz) Tickets be costed, at standard cost, as they are received.

The Foundry account also is credited with the scrap value of the scrap reported, in the same manner as is now accomplished. The balance in the foundry account is the Work in Process plus the efficiency variance of the foundry.

The Work in Process is determined as follows: As each Foundry Production Schedule is received it is costed as though the castings were finished. The sum of these is the input for the period. As the scrap reports are received they, too, are costed as though they were finished castings. The sum of the scrap and the finished castings delivered is the output of the foundry, and the difference between input and output is the Work in Process. This is subtracted from the balance of the account to obtain the Efficiency Variance. Since the act of determining WIP also determines the value of the scrap produced, the efficiency variation may be divided into two parts. One of these is the Scrap variance (the difference between the value of actual and budgeted scrap) and the other is the remainder of the variance. It should be noted that all of the balance of the foundry account is concerned with activities after shakeout. This is essentially correct since there is no material left in the Melting department at the close of each day's operation and since only very few molds are produced which are not poured. Those few which are molded but not poured are ignored, a procedure believed justified in view of their small quantity.

The value of the castings removed from the foundry (9) is debited to an account entitled simply "Castings". The reason for this name will become apparent after the accounting procedure for the machine shop has been explained.

The Machine Shop Variance account is similar to that of the Molding and Coremaking departments. It is debited with the actual direct expenses and the standard Service Cost Center expenses, and credited (11) with the actual hours worked multiplied by the composite rate. Its balance is the sum of the Activity and Expense Variances, which may be separated as were those of Molding and Coremaking.

The Machine Shop account has debited to it only the single entry (11) mentioned in the above paragraph.

As each day's production of finished valves is received on the Daily Assembly and Test Report, the valves are costed at standard cost. Furthermore this cost must be broken down into standard cost of castings, standard cost of machining and standard cost of purchased parts. In addition the standard machine shop hours for each valve must be recorded and totaled.

The total machine shop standard cost of the valves produced is credited to the Machine Shop account (12). The total cost of the purchased parts is credited to the Purchased Parts account (10), and the total cost of the castings is credited to the Castings account (13). The sum of these three totals is debited to Finished Goods.

The balance in the Machine Shop account is now the sum of the Work in Process and the Machine Shop Efficiency Variance. These must be separated in a manner somewhat different from that used in the Foundry.

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[illegible]

[illegible]

input to the account was the actual hours worked by the machine shop; this includes the standard hours and variance. The standard input is determined by totaling the standard hours reported by the shop for the purpose of computing incentive pay. The output is the standard machining hours of the valves produced. These were obtained from the Assembly Report and now are subtracted from the standard hour input. The remainder, multiplied by the composite rate for the machine shop, is the Machine Shop Work in Process. This is the value of the machine shop labor and overhead applied to the work in process and does not include the value of the castings or purchased parts. This value of WIP is substracted from the balance of the machine shop account to obtain the Machine Shop Efficiency Variance.

Accounting for scrap in the machine shop presents something of a problem. This scrap may come about in two ways. In the first case, the machine shop may discover defects in ostensibly good castings which make them unusable; and this discovery may not occur until months after the castings have been delivered by the foundry and entered into the Castings account. Since it obviously is impracticable to correct the foundry records some months back, only two alternatives are available. Either the foundry must be charged for the scrap during the present month, thus increasing this month's unfavorable efficiency variance, or a separate variance must be set up. Since the former alternative hardly seems fair, the separate variance appears to be the only answer. Therefore the machine shop account is relieved of the value of labor and overhead (actual hours multiplied by composite rate) already applied

to the casting and the Castings account is relieved of the cost of the casting. The sum of these is the new variance, which like the other variances must be debited directly to Profit and Loss, as explained below.

The case of scrap actually produced by faulty work in the machine shop is somewhat simpler. In this case the machine shop already is charged with the labor and overhead expended, and the account is not relieved of this amount. Hence the costs already applied to the casting appear in the efficiency variance of the machine shop. However, the scrap value of the casting is credited to the machine shop, partially offsetting the above costs. The Castings account must be relieved of the standard cost of the casting and it seems only fair to debit this to the Machine Shop account, thus further increasing any unfavorable efficiency variance. These transactions are not shown on Figure XI-2.

It now can be seen why the Castings and the Machine Shop accounts were so named. The Machine Shop account contains only labor and overhead; the Castings account contains all castings from the time they are delivered by the foundry until they are reported as finished valves. It is not possible to determine the value of the castings actually in the machine shop unless a special report is made by the shop of all castings removed from storage and entered into the machine shop. This report seems to be unjustified purely for accounting purposes and is not required for inventory control.

The Finished Goods account now has been debited with the standard cost of all valves produced. It is credited, and Cost of Goods Sold debited (14), with the value of the valves as they are sold. Consequently the Finished Valves and the Cost of Goods Sold accounts are

correct and up to date.

In order to close the variance accounts and the process accounts the variances are posted directly to profit and loss. The profit and loss statement for each accounting period will then show sales less standard cost of goods sold as the "standard" profit. From this will be deducted all the variances (assuming they are unfavorable) to obtain the actual profit. This difference between "standard" and actual profit will be top management's principal source of information as to the cost of operation. Its timely and accurate presentation to top management in an easily understood form is of the utmost significance.

In addition, of course, the variances must be presented to the foremen of the cost centers. It is not practicable to present the Expense Variance more often than once a month, but the Activity and Efficiency Variances probably should be presented weekly. This weekly report of variances to the foremen, with copies and a summary to the Vice President in charge of Manufacturing, should take the place of most of the weekly statistical analysis now presented.

Figure XI-3 is a suggested form for the monthly report to a foundry cost center; the weekly report may be a simplified version of this form or it may be prepared on the same form, ignoring the expense variation items.

3.9 SUMMARY

As has been stated previously, the system described probably will not be exactly the system ultimately adopted by the Accounting De-

partment. However, it is an adequate system which will work for this company. Furthermore, the costs of operating the system are believed to be not excessive. It should be noted that the system requires no additional reports from the factory to the Accounting Department; all the additional work is performed by the Accounting Department. The principal amount of this additional work is the costing of each day's Foundry Production Schedule, Froundry Delivery Tickets for good castings and for scrap, and the Daily Assembly and Test Report. This additional labor will be offset partially by the fact that a large amount of the statistical analysis now performed will no longer be necessary. The costing of good castings and scrap would provide the cost basis necessary for a quality control system and would furnish top management accurate cost data for "quality" decisions.

[illegible]
MONTHLY VARIANCE REPORT -- FOUNDRY

Month ________ Cost center ________
Foreman ________

EXPENSE

Item	Budget	Variance Month	Variance Yr. to Date
Indirect labor			
Supplies			
Etc.			
Etc.			

ACTIVITY

Budgeted Direct Labor Hours ________

Actual Direct Labor Hours ________

Variance $________

EFFICIENCY

Total Variance $________

Scrap budgeted at Standard Cost $________

Scrap produced at Standard Cost $________

Scrap Variance $________

Remainder of Variance $________

SCRAP REPORTED BY MACHINE SHOP

$________

Fig. XI-3

Tyree, E. A.

APPENDICES TO

MANAGEMENT ENGINEERING REPORT

on the

RENSSELAER VALVE COMPANY

of

Cohoes, New York

Vol. 2

By

Naval Officers in the Management Engineering Department

[Vol. 1 - Text
Vol 2 - Appendices]

Submitted to the Faculty of Rensselaer Polytechnic Institute in partial fulfillment of the requirements for the Master of Science Degree.

Rensselaer Polytechnic Institute
Troy, New York
June 1954

RENSSELAER VALVE CO.
Orders Received and Unfilled

A 94 1M 11-53

WEEK ENDING

ICE	WEEK				YEAR TO DATE			
	VALVES	HYDRANTS	HYDRANT REPAIRS	TOTAL	VALVES	HYDRANTS	HYDRANT REPAIRS	TOTAL
sas								
a								
o								
nati								
do								
s								
geles								
his								
gland								
ork								
oma								
lphia								
rgh								
ncisco								
l								
s								
n								
a Repairs								

l eceived				
n at ng				
Totals				
nts				
ll r at End				

~~25570~~
28854

Repairs included hydrant total received.
ied Stock—Unfilled Orders at End:— 2.1

e__________ Hydrants__________ TOTAL__________

Booked by State and Sales Territory for March 195[illegible]

CODE BY STATE	STATE	AMOUNT	
		MONTH	YEAR TO DATE
1	Alabama		
2	Alaska		
3	Arizona		
4	Arkansas		
5	California		
6	Colorado		
7	Connecticut		
8	Delaware		
9	District of C		
10	Florida		
11	Georgia		
12	Idaho		
13	Illinois		
14	Indiana		
15	Iowa		
16	Kansas		
17	Kentucky		
18	Louisiana		
19	Maine		
20	Maryland		
21	Massachusetts		
22	Michigan		
23	Minnesota		
24	Mississippi		
25	Missouri		
26	Montana		
27	Nebraska		
28	Nevada		
29	New Hampshire		
30	New Jersey		
31	New Mexico		
32	New York		
33	North Carolina		
34	North Dakota		
35	Ohio		
36	Oklahoma		
37	Oregon		
38	Pennsylvania		
39	Rhode Island		
40	South Carolina		
41	South Dakota		
42	Tennessee		
43	Texas		
44	Utah		
45	Vermont		
46	Virginia		
47	Washington		
48	West Virginia		
49	Wisconsin		
50	Wyoming		
102	Canada		
103	Venezuela		
	Guatemala		

BY TERRITORY & STATE

TERRITORY	STATE	AMOUNT	
		MONTH	YEAR TO DATE
532 Neptune Equip.Co.	------		
533 Export	Canada		
	Guatemala		
562	Florida		
	Georgia		
	North Carolina		
	South Carolina		
Total			
563 Chicago	Illinois		
	Indiana		
	Iowa		
	Michigan		
	Minnesota		
	Nebraska		
	North Dakota		
	South Dakota		
	Wisconsin		
Total			
564 Memphis	Alabama		
	Kentucky		
	Mississippi		
	Tennessee		
	Missouri		
Total			
565 Los Angeles	Arizona		
	California		
Total			
566 New England	Conn.		
	Maine		
	Mass.		
	New Hampshire		
	Rhode Island		
	Vermont		
Total			
567 New York	New Jersey		
	New York		
	Penna.		
Total			
568 Philadelphia	Delaware		
	Maryland		
	New Jersey		
	Penna.		
	Virginia		
Total			
569 Connelly	Oklahoma		
Total			

BY TERRITORY & STATE

TERRITORY	STATE	AMOUNT MONTH	AMOUNT YEAR TO DATE
570 Pittsburgh	[illegible]		
	Ohio		
	[illegible]		
Total			
571 San Carlos	Calif.		
	Nevada		
	Oregon		
Total			
572 Seattle	Alaska		
	Idaho		
	Montana		
	Oregon		
	Washington		
Total			
573 Denver M & S	Colorado		
	New Mexico		
	S. Dakota		
	Wyoming		
Total			
574 Texas	Texas		
Total			
575 Kansas Pensinger	Kansas		
	Missouri		
576 Troy	W. Virginia		
Total			
578 Arkansas	Arkansas		
	Louisiana		
	Missouri		
Total			
	GRAND TOTAL		

CONSIGNED STOCK INVENTORY

(2.3)

Branch: ______________

Date: ______________

Size	List No.	Style	Open	In Stock	Holding for Shipment	In Transit from Prov.	Total Stock		Unit
		Gate Valves							
2"	13A	Hub	L						
2"	13A	Hub	R						
2"	13A	Flange	L						
2"	13A	Screw End	L						

CONSIGNED STOCK

DATE	ORDER NO.	SHIPPED TO	SHIPPED FROM	BAL.	DATE	ORDER NO.	SHIPPED TO	SHIPPED FROM	BAL.	DATE	ORDER NO.	SHIPPED TO	SHIPPED FROM	BAL	DATE	ORDER NO.	SHIPPED TO	SHIPPED FROM	BAL.

LINE NO. | ITEM

FORM 207—1M-7-51

2.4

RENSSELAER VALVE CO.

GATE VALVES & FIRE HYDRANTS

TROY, N. Y.

CUSTOMER'S ORDER NO. - DATE	DATE ENTERED	BRANCH	OUR ORDER NO.	SHIPMENT NO.	INVOICE
				INV. B. O. 1	№

____ OF ____

TERMS
NET 30 DAYS

DATE SHIPPED

SHIPPED FROM

PREPAID COLLECT

ED

F.O.B.

VIA

DESCRIPTION	UNIT PRICE	QUANTITY BACK ORD'D	QUANTITY SHIPPED	AMOUNT

DO NOT TYPE IN THIS SPACE

SHIPPING SCHEDULE

2.5

ORDER MASTER

CM80735 " DITTOforms ®

Rensselaer Valve Co.

GATE VALVES & FIRE HYDRANTS

Troy, N. Y.

CUSTOMER'S ORDER NO. · DATE | DATE ENTERED | BRANCH | OUR ORDER NO.

_______ OF _______

TERMS:
NET 30 DAYS

DATE
SHIPPED

SHIPPED FROM

PREPAID COLLECT

ED

F.O.B.

VIA

	DESCRIPTION	UNIT PRICE	QUANTITY BACK ORD'D.	QUANTITY SHIPPED	AMOUNT

PPING SCHEDULE

2.6

SALES

1-54-LF80736 DITTOforms

Rensselaer Valve Co.

GATE VALVES & FIRE HYDRANTS

TROY, N. Y.

CUSTOMER'S ORDER NO. - DATE DATE ENTERED BRANCH OUR ORDER NO.

________ OF ________

TERMS:
NET 30 DAYS

DATE
SHIPPED

SHIPPED FROM

PREPAID COLLECT

ED

F.O.B. VIA

DESCRIPTION	UNIT PRICE	QUANTITY BACK ORD'D.	QUANTITY SHIPPED	AMOUNT
ACKNOWLEDGMENT				

ALL ORDERS ARE ACCEPTED AND CONTRACTS MADE SUBJECT TO OUR ABILITY TO OBTAIN MATERIALS AND TO RISKS AND DELAYS CAUSED BY STRIKES, ACCIDENTS, TRANSPORTATION OR CAUSES BEYOND OUR CONTROL.

PPING SCHEDULE

CUSTOMER'S ACKNOWLEDGMENT

1-54-LF80736 DITTOforms

RENSSELAER VALVE CO.

GATE VALVES & FIRE HYDRANTS

TROY, N. Y.

CUSTOMER'S ORDER NO. - DATE | DATE ENTERED | BRANCH | OUR ORDER NO.

_______ OF _______

TERMS:
NET 30 DAYS

DATE SHIPPED

SHIPPED FROM

PREPAID COLLECT

ED

F.O.B.

VIA

DESCRIPTION	UNIT PRICE	QUANTITY BACK ORD'D	QUANTITY SHIPPED	AMOUNT

PPING SCHEDULE

RECORDS COPY

1-54-LF80736 DITTOforms ®

RENSSELAER VALVE CO.

GATE VALVES & FIRE HYDRANTS

TROY, N. Y.

CUSTOMER'S ORDER NO. - DATE | DATE ENTERED | BRANCH | OUR ORDER NO.

_______ OF _______

TERMS:
NET 30 DAYS

DATE
SHIPPED

SHIPPED FROM

PREPAID COLLECT

F.O.B.

VIA

DESCRIPTION	UNIT PRICE	QUANTITY BACK ORD'D.	QUANTITY SHIPPED	AMOUNT

H PING SCHEDULE

STATISTICAL COPY

1-54-LF80736 DITTOforms ®

RENSSELAER VALVE CO.

GATE VALVES & FIRE HYDRANTS

TROY, N. Y.

CUSTOMER'S ORDER NO. · DATE | DATE ENTERED | BRANCH | OUR ORDER NO.

_______ OF _______

TERMS:
NET 30 DAYS

DATE SHIPPED

SHIPPED FROM

PREPAID COLLECT

D

F.O.B.

VIA

DESCRIPTION	UNIT PRICE	QUANTITY BACK ORD D	QUANTITY SHIPPED	AMOUNT

'PING SCHEDULE

PRODUCTION COPY

RENSSELAER VALVE CO.

GATE VALVES & FIRE HYDRANTS

TROY, N. Y.

CUSTOMER'S ORDER NO. - DATE | DATE ENTERED | BRANCH | OUR ORDER NO.

_______ OF _______

TERMS
NET 30 DAYS

DATE
SHIPPED

SHIPPED FROM

PREPAID COLLECT

ED

F.O B

VIA

DESCRIPTION

PPING SCHEDULE

SHOP COPY

1-54 LF80736 DITTOforms ®

RENSSELAER VALVE CO.

GATE VALVES & FIRE HYDRANTS

TROY, N. Y.

CUSTOMER'S ORDER NO. - DATE   DATE ENTERED   BRANCH   OUR ORDER NO.

_______ OF _______

TERMS:
NET 30 DAYS

DATE SHIPPED

SHIPPED FROM

PREPAID COLLECT

ED

F.O.B.

VIA

DESCRIPTION

PPING SCHEDULE

SHOP COPY

1-54 LF80736 DITTOforms ®

RENSSELAER VALVE CO.

GATE VALVES & FIRE HYDRANTS

TROY, N. Y.

CUSTOMER'S ORDER NO. - DATE | DATE ENTERED | BRANCH | OUR ORDER NO.

________ OF ________

TERMS:
NET 30 DAYS

DATE SHIPPED

SHIPPED FROM

ED

F.O B.

PREPAID COLLECT

VIA

DESCRIPTION

PPING SCHEDULE

SHOP COPY

RENSSELAER VALVE CO.

GATE VALVES & FIRE HYDRANTS

TROY, N. Y.

CUSTOMER'S ORDER NO. - DATE | DATE ENTERED | BRANCH | OUR ORDER NO

SHPMT. NUMBER

_______ OF _______

TERMS:
NET 30 DAYS

DATE SHIPPED ___________

NO PKGS. ___________ WT. ___________

SHIPPED FROM

PREPAID COLLECT

ED

F.O.B

VIA ___________

DESCRIPTION

PING SCHEDULE

SHIPPERS COPY

1-54-LF80736 DITTOforms ®

Rensselaer Valve Co.

GATE VALVES & FIRE HYDRANTS

TROY, N. Y.

STOMER'S ORDER NO. - DATE	DATE ENTERED	BRANCH	OUR ORDER NO.	INVOICE
				SHIPMENT NUMBER N°

_____ OF _____

TERMS:
NET 30 DAYS

DATE SHIPPED

SHIPPED FROM

PREPAID COLLECT

F.O.B.

VIA

DESCRIPTION	UNIT PRICE	QUANTITY BACK ORD'D.	QUANTITY SHIPPED	AMOUNT

ORIGINAL INVOICE

2.7

1-54-LF80736 DITTOforms ®

I certify that the above bill is correct and just; that payment therefor has not been received; that all statutory requirements as to American production and labor standards, and all conditions of purchase applicable to the transactions have been complied with: and that State or local sales taxes are not included in the amounts billed.

RENSSELAER VALVE CO.

By ....

Vice President - Treasurer
Asst. Secretary

To the best of our knowledge and belief all prices shown on this invoice are not in excess of any maximum price established by the Office of Price Administration under the Emergency Price Control Act of 1942.

All errors must be reported upon receipt of goods.

This company will not be responsible for cracked or broken material after consignee has receipted for same in good condition.

We have transportation company's receipt for this shipment acknowledging delivery to it in good condition and agreeing to deliver at destination in good condition. Therefore, for your own protection, have transportation company's agent verify damages or shortages, if any, and note same on the freight bill over his signature. These freight bills, with original bill-ladings, must accompany claim for damages if such is made.

By order of Interstate Commerce Commission, carriers cannot pay claims for damages unless filed with them within six (6) months after delivery of shipment. Therefore, any claim of this nature should be handled immediately.

RENSSELAER VALVE CO.

GATE VALVES & FIRE HYDRANTS

TROY, N. Y.

CSTOMER'S ORDER NO. - DATE	DATE ENTERED	BRANCH	OUR ORDER NO.	INVOICE
				SHIPMENT NUMBER Nº

______ OF ______

TERMS:
NET 30 DAYS

DATE SHIPPED

SHIPPED FROM

PREPAID COLLECT

F.O.B.

VIA

DESCRIPTION	UNIT PRICE	QUANTITY BACK ORD D.	QUANTITY SHIPPED	AMOUNT

DUPLICATE INVOICE

1-54-LF80736 ® DITTOforms ®

RENSSELAER VALVE CO.

GATE VALVES & FIRE HYDRANTS

TROY, N. Y.

CUSTOMER'S ORDER NO. - DATE | DATE ENTERED | BRANCH | OUR ORDER NO.

INVOICE

SHIPMENT NUMBER

Nº

______ OF ______

TERMS:
NET 30 DAYS

DATE SHIPPED

SHIPPED FROM

PREPAID COLLECT

F.O.B.

VIA

DESCRIPTION	UNIT PRICE	QUANTITY BACK ORD D.	QUANTITY SHIPPED	AMOUNT

INVOICE

1-54-LF80736 DITTOforms ®

RENSSELAER VALVE CO.

GATE VALVES & FIRE HYDRANTS

TROY, N. Y.

USTOMER'S ORDER NO. - DATE	DATE ENTERED	BRANCH	OUR ORDER NO.	INVOICE

SHIPMENT NUMBER

No

OF

DATE SHIPPED

TERMS:
NET 30 DAYS

SHIPPED FROM

PREPAID COLLECT

D

F.O.B.

VIA

DESCRIPTION	UNIT PRICE	QUANTITY BACK ORD'D.	QUANTITY SHIPPED	AMOUNT

INVOICE

1-54-LF80736 DITTOforms ®

Rensselaer Valve Co.

GATE VALVES & FIRE HYDRANTS

TROY, N. Y.

(U)STOMER'S ORDER NO. · DATE | DATE ENTERED | BRANCH | OUR ORDER NO.

SHIPMENT NUMBER

INVOICE

Nº

_____ OF _____

TERMS:
NET 30 DAYS

DATE SHIPPED

SHIPPED FROM

PREPAID COLLECT

F.O.B

VIA

DESCRIPTION	UNIT PRICE	QUANTITY BACK ORD'D.	QUANTITY SHIPPED	AMOUNT

INVOICE

1-54 LF80736 DITTOforms ®

Rensselaer Valve Co.

GATE VALVES & FIRE HYDRANTS

TROY, N. Y.

STOMER'S ORDER NO. - DATE | DATE ENTERED | BRANCH | OUR ORDER NO.

SHIPMENT NUMBER

INVOICE

No.

________ OF ________

TERMS:
NET 30 DAYS

DATE SHIPPED

SHIPPED FROM

PREPAID COLLECT

F.O.B.

VIA

DESCRIPTION	UNIT PRICE	QUANTITY BACK ORD'D.	QUANTITY SHIPPED	AMOUNT

INVOICE

1-54-LF80736 DITTOforms ®

SOLD TO	NO. REQ'D.	S.O.	NO.
		DATE	
		BM BK. PG.	SHEET OF
SHIP TO			ASSEMBLY DWG. NO.
	SCHEDULE		OPEN LT. RT.

VERT IN HORIZ PIPE
HORIZ. IN HORIZ. PIPE
FLAT IN VERT. PIPE

LINE	PART NAME	CAST	MACH.	WEIGHT	REQ. ONE UNIT	CASTING NO.	PART NO.	MAT'L	DRAWING NO.	
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
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38										
39										
40										
41										
42										
43										
44										
45										
46										
47										
48										
49										
50						3.1				
51										
52										
53										

RENSSELAER VALVE CO.'S QUOTATION

DUE:
SUBJECT:

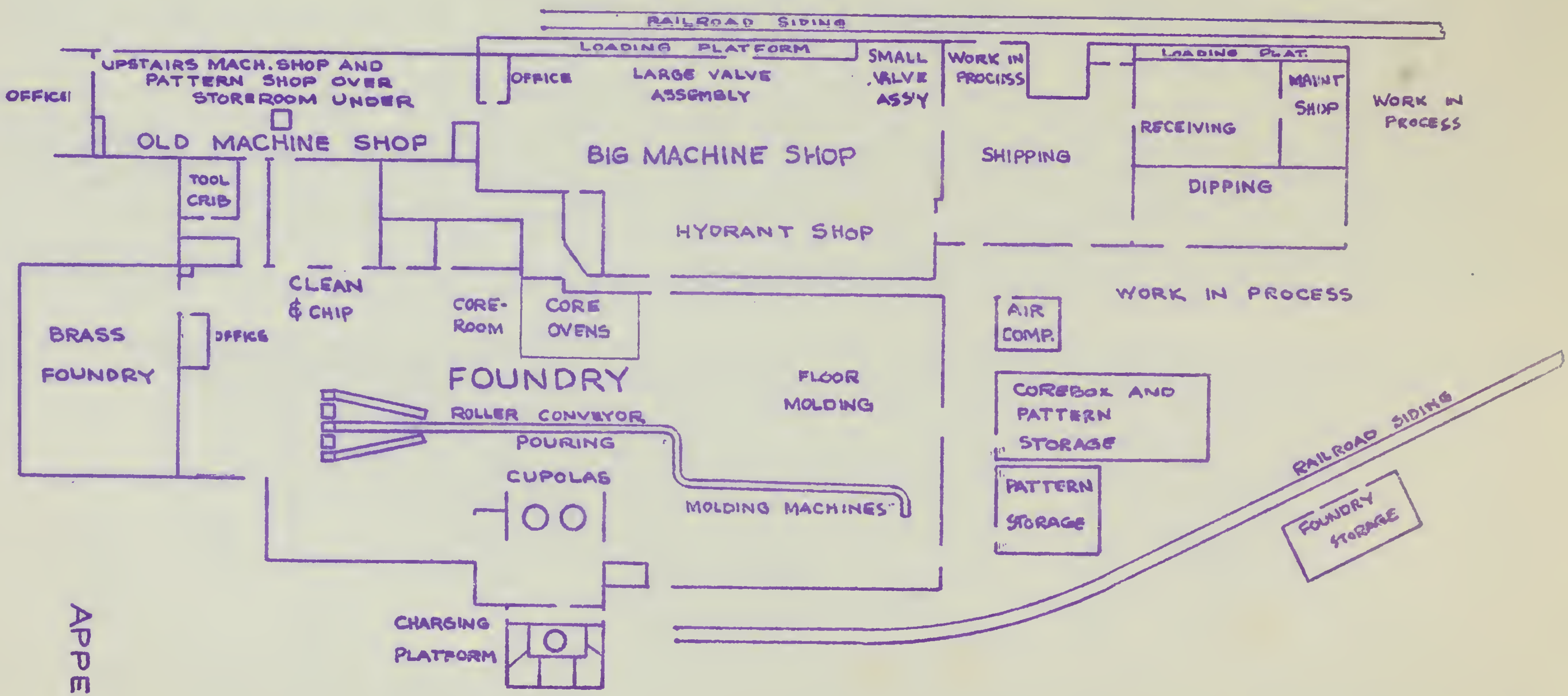
SHEET OF
DATE

STANDARD QUOTATION

INQUIRY
ENG R

1				
3	ITEM No	ITEM No.	ITEM No.	ITEM No.
4	QUAN	QUAN.	QUAN.	QUAN.
5	SIZE	SIZE	SIZE	SIZE
6	LIST	LIST	LIST	LIST
7				
8	NRS	NRS	NRS	NRS
9	OS&Y	OS&Y	OS&Y	OS&Y
10	SLID'G RIS'G.	SLID'G. RIS'G.	SLID'G. RIS'G.	SLID'G RIS'G
11				
12	HUB	HUB	HUB	HUB
13	MECH. JOINT	MECH. JOINT	MECH. JOINT	MECH. JOINT
14	FLANGE	FLANGE	FLANGE	FLANGE
15	SCREW	SCREW	SCREW	SCREW
16	HUB x FLG.	HUB x FLG.	HUB x FLG.	HUB x FLG.
17	FLG. x M.J.	FLG. x M.J.	FLG. x M.J.	FLG. x M.J.
18				
19	WORK'G PRESS.	WORK'G PRESS.	WORK'G PRESS.	WORK'G PRESS
20	TEST PRESS.	TEST PRESS	TEST PRESS.	TEST PRESS.
21	SINGLE SQ	SINGLE SQ.	SINGLE SQ.	SINGLE SQ.
22	DOUBLE SQ.	DOUBLE SQ.	DOUBLE SQ.	DOUBLE SQ.
23				
24	OPER. NUT	OPER. NUT	OPER. NUT	OPER. NUT
25	HANDWH'L	HANDWH'L	HANDWH'L	HANDWH'L
26				
	OPEN RT.	OPEN RT.	OPEN RT.	OPEN RT.
28	OPEN LT	OPEN LT.	OPEN LT.	OPEN LT.
29	BEVEL GR.	BEVEL GR.	BEVEL GR.	BEVEL GR.
30	SPUR GR.	SPUR GR.	SPUR GR.	SPUR GR.
31	INDICATOR	INDICATOR	INDICATOR	INDICATOR
32				
34	R. T. S.	R. T. S.	R. T. S.	R. T. S.
35	INT. GR. C'SE	INT. GR. C'SE	INT. GR. C'SE	INT. GR. C'SE
36	EXT. GR. C'SE	EXT. GR. C'SE	EXT. GR. C'SE	EXT. GR. C'SE
37	BYPASS	BYPASS	BYPASS	BYPASS
38	BYP. OP. NUT	BYP. OP. NUT	BYP. OP. NUT	BYP. OP. NUT
39	BYP. H'DW'L	BYP. H'DW'L	BYP. H'DW'L	BYP. H'DW'L
40	V. IN H. PIPE	V. IN H. PIPE	V. IN H. PIPE	V. IN H. PIPE
41	H. IN H. PIPE	H. IN H. PIPE	H. IN H. PIPE	H. IN H. PIPE
42	FLAT IN V. "	FLAT IN V. "	FLAT IN V. "	FLAT IN V. "
43				
44	RT. W. FLOW	RT. W. FLOW	RT. W. FLOW	RT. W. FLOW
45	LT. W. FLOW	LT. W. FLOW	LT. W. FLOW	LT. W. FLOW
46				
47	BRZ. BUSH	BRZ. BUSH.	BRZ. BUSH,	BRZ BUSH.
48	BRZ. INCL.	BRZ. INCL..	BRZ. INCL.	BRZ. INCL.
49				
50	COUPLING	COUPLING	COUPLING	COUPLING
51	EXT. STEM	EXT. STEM	EXT. STEM	EXT. STEM
52	C/L TO TOP	C/L TO TOP	C/L TO TOP	C/L TO TOP
	C/L TO FLOOR	C/L TO FLOOR	C/L TO FLOOR	C/L TO FLOOR
	FLOORSTAND	FLOORSTAND	FLOORSTAND	FLOORSTAND
55				
56	ADJ. GUIDE	ADJ. GUIDE	ADJ. GUIDE	ADJ. GUIDE
57	GEAR CASE	GEAR CASE	GEAR CASE	GEAR CASE
58				
59				

3.2



PLANT LAYOUT
RENSSELAER VALVE CO.
COHOES, N.Y.
MAY 1954 SCALE 1"=60'

APPENDIX 41

PROCESS FLOW CHART OF PRESENT METHOD
FOR THE MANUFACTURE OF LIST 18A, 5" M/J VALVES

SUMMARY

PIECE	◯	○	▽	□	DIST
COVER	5	21	18	2	1055
CASE	5	23	24	2	1153
GATE	5	18	16	2	1152
SEAT RING	3	11	19	1	550
GATE RING		3	3		232
WEDGE & PLOW ASS'Y	4	7	6	1	423
FOLLOWER GLAND	1	9	8		527
STUFFING BOX	2	13	11	2	666
FOLLOWER PLATE	1	8	7		603
WRENCH NUT	3	4	4	1	370
STEM	1	6	4		387
STEM NUT	1	7	8		397
PURCH. PARTS – PEGS & STRAP		2	4		762
" " – PLOW		1	2		56
" " – PACKING	1	2	2		380
" " – OTHERS		9	18		3375
GATE ASS'Y	3	2	1	1	38
VALVE ASS'Y, TEST, PAINT	15	17	4	1	227
TOTAL	50	163	145	13	12,252

No	DESCRIPTION	◯	○	▽	□	DIST	HRS/100 PCS
	—COVER—						
1	IN YARD						
2	TO DIP SHED					70	
3	WAIT						
4	TO DIP					5	
5	DIP						
6	TO DRAIN					4	
7	DRAIN						
8	TO PALLET					9	
9	WAIT COMPLETION LOT						
10	WAIT TRANS						
11	TO YARD					70	
12	IN YARD						
13	TO MACHINE SHOP					450	
14	WAIT						
15	TO MACH. NO 159					10	
16	WAIT						
17	TO MACH.					5	
18	MILL NECK FLANGE						6.27
19	INSPECT FLANGE						
20	TO PALLET					5	
21	WAIT COMPLETION OF LOT						
22	WAIT TRANSPORTATION						
23	TO STORAGE					6	
24	STORAGE						
25	TO STOR. AT MACH 158					5	
26	WAIT						
27	TO MACH					5	
28	DRILL & TAP PLUG HOLE						2.22
29	TO PALLET					5	
30	WAIT COMPLETION OF LOT						
31	TO STORAGE					19	
32	STORAGE						
33	TO STOR. AT MACH 148					13	
34	WAIT MACH						
35	TO MACH					5	
36	BORE & COUNTERBORE						2.77
37	INSPECT						
38	TO STORAGE					5	
39	STORAGE						
40	TO STORAGE AT MACH 115					4	
41	WAIT MACH.						
42	DRILL NECK FLANGE						2.64
43	TO PALLET					5	
44	WAIT COMPL. OF LOT						
45	TO STOR. NEAR ASS'Y AREA					290	
46	STORAGE						
47	TO ASS'Y AREA					65	
48	WAIT ASS'Y						
	TOTAL	5	21	18	2	1055	

PRESENT METHOD CONT.

NO	DESCRIPTION—CASE—	O	o	▽	□	DIST	HRS 100 PCS
1	STORAGE IN YARD						
2	TO DIP SHED					86	
3	WAIT DIP						
4	TO DIP					5	
5	DIP						
6	TO DRAIN					4	
7	DRAIN						
8	TO PALLET					9	
9	WAIT COMPL. OF LOT						
10	WAIT TRANS.						
11	TO YARD					80	
12	STORAGE						
13	TO MACH. SHOP					416	
14	STORAGE						
15	TO STOR. AT MACH 140					11	
16	WAIT MACHINE.						
17	TO MACHINE					5	
18	DRILL END FLANGES						5.88
19	TO PALLET					5	
20	WAIT COMPL. OF LOT						
21	WAIT TRANS.						
22	TO STORAGE					35	
23	STORAGE						
24	TO STOR. AT MACH 159					10	
25	WAIT MACH						
26	TO MACH					5	
27	MILL NECK FLANGE						6.27
28	INSPECT NECK FLANGE						
29	TO PALLET					5	
30	WAIT COMPL. OF LOT						
31	WAIT TRANS						
32	TO STORAGE					24	
33	STORAGE						
34	TO STOR. AT MACH 140					11	
35	WAIT MACH						
36	TO MACH No 140					5	
37	DRILL NECK FLANGES						2.71
38	TO PALLET					5	
39	WAIT COMPL. OF LOT						
40	WAIT TRANS						
41	TO STORAGE					60	
42	STORAGE						
43	TO STOR. AT MACH. 156					4	
44	WAIT MACH.						
45	TO MACH 156					6	
46	RING						19.71
47	INSPECT						
48	TO PALLET					7	
49	WAIT COMPL. OF LOT						
50	WAIT TRANS.						
51	TO STOR. AT ASS'Y AREA					290	
52	STORAGE						
53	TO ASSEMBLY AREA					65	
54	WAIT ASSEMBLY						
	TOTALS	5	23	24	2	1153	

WEDGE & PLOWS

NO	DESCRIPTION	O	o	▽	□	DIST	HRS 100 PCS
1	STOR. IN BASEMENT BIN						
2	HOOK ON WEDGE						
3	CARRY TO DIP TROUGH					13	
4	IMMERSE WEDGE IN PAINT						
5	HANG ON RACK						
6	DRAIN						
7	INSPECT						
8	TO BIN					13	
9	STORAGE						
10	TO BENCH FOR PLOW ASS'Y					15	
11	WAIT PLOW ASS'Y						
12	TO FIXTURE					2	
13	ASSEMBLE PLOWS TO WEDGE						2.96
14	TO BIN					12	
15	STORAGE						
16	BIN TO BARREL					3	
17	TO STOR. AT GATE ASS'Y AREA					365	
18	WAIT GATE ASS'Y						
	TOTALS	4	7	6	1	423	

No	Description	O	o	▽	□	Dist	Hrs / 100 pcs
	—GATE—						
1	Storage in yard						
2	To dip shed					96	
3	Storage						
4	To dip basket					1	
5	To dip tank					4	
6	Dip						
7	To drain rack					4	
8	From basket to rack					1	
9	Drain						
10	To tote box					4	
11	Wait compl. of lot						
12	Wait trans.						
13	To yard					90	
14	Storage						
15	To mach. shop					512	
16	Storage						
17	To stor. at mach. 151					8	
18	Wait mach.						
19	To mach					5	
20	Face & groove						9.41
21	Inspect						
22	Ring						
23	Inspect						
24	To tote box					4	
25	Wait completion of lot						
26	Wait trans.						
27	To stor at mach 125					25	
28	Wait mach.						
29	To mach.					5	
30	Drill peg hole						1.58
31	To tap					4	
32	Wait tap						
33	Tap peg hole						
34	To tote box					5	
35	Wait compl. of lot						
36	Wait trans.						
37	To stor. near. ass'y area					316	
38	Storage						
39	From tote box to barrel					3	
40	Barrel to gate ass'y area					65	
41	Wait assembly						
	TOTALS	5	18	16	2	1152	
	GATE ASSEMBLY						
1	Parts in storage near bench						
2	Parts to bench as req'd					30	
3	Assemble gate						
4	Carry to valve ass'y bench					8	
5	Inspect interior of case						
6	Chisel obstructions as req'd						
7	Seat gate ass'y in case						
	TOTALS	3	2	1	1	38	
	—STEM—						
1	Storage in basement						
2	To barrell					3	
3	To storage at mach 147					346	
4	To tote box at mach					3	
5	Wait mach.						
6	To mach.					5	
7	Machine						5.61
8	To tote box					6	
9	Wait compl. of lot						
10	To stor. bin at ass'y area					24	
11	Wait ass'y						
	TOTALS	1	6	4		387	
	—GATE RING—						
1	Storage in basement in drum						
2	To storage at mach 151					222	
3	Storage						
4	To stor. on mach					8	
5	Stor. on turret						
6	To work					2	
7	Ring gate - see step 20 - gate						
	TOTAL		3	3		232	

NO	DESCRIPTION	○	o	▽	□	DIST	HRS/100 PCS
	STUFFING BOX—						
1	STORAGE IN BASEMENT BIN						
2	TO MACHINE SHOP					118	
3	STORAGE						
4	TO STORAGE AT MACH 116					15	
5	WAIT MACHINE						
6	TO MACH. 116					4	
7	BORE						1.22
8	INSPECT						
9	TO TOTE BOX					4	
10	WAIT COMPL. OF LOT						
11	WAIT TRANS.						
12	TO STORAGE					13	
13	STORAGE						
14	TO STOR. AT MACH 117					36	
15	WAIT MACH.						
16	TO MACH.					3	
17	LAP OFF						1.53
18	INSPECT						
19	TO TOTE BOX					4	
20	WAIT COMPL. OF LOT						
21	WAIT TRANS.						
22	TO BASEMENT BIN STORAGE					153	
23	TOTE BOX TO BIN					4	
24	STORAGE						
25	BIN TO BARREL					3	
26	TO ASS'Y AREA BIN STORAGE					306	
27	BARREL TO BIN					3	
28	WAIT ASSEMBLY						
	TOTALS	2	13	11	2	666	
	—SEAT RING—						
1	STORAGE IN BASEMENT BIN						
2	TO MACHINE SHOP					154	
3	WAIT						
4	TO BENCH AT MACH. 66					5	
5	WAIT MACH						
6	TO MACH					5	
7	TURN & FACE						2.80
8	INSPECT						

NO	DESCRIPTION	○	o	▽	□	DIST	HRS/100 PCS
9	THREAD & CHASE						
10	TO BENCH					5	
11	WAIT COMPL. OF LOT						
12	TO BENCH AT MACH 65					7	
13	WAIT MACH.						
14	TO MACH					3	
15	CHAMFER						1.36
16	TO BENCH					5	
17	WAIT COMPL. OF LOT						
18	WAIT TRANS.						
19	TO BASEMENT					209	
20	STORAGE						
21	TO BARREL					5	
22	TO MACH 156					147	
23	WAIT MACH.						
24	TO MACH.					5	
25	RING CASE - STEP 46 - CASE						
	TOTALS	3	11	9	1	550	
	—FOLLOWER GLAND—						
1	STORAGE IN BASEMENT BIN						
2	BIN TO BARREL						
3	TO STOR. AT MACH 63					127	
4	WAIT MACHINE						
5	TO BENCH					6	
6	WAIT MACH						
7	TO MACH					3	
8	BORE						1.41
9	TO BENCH					3	
10	WAIT COMPL. OF LOT						
11	TO BARREL					5	
12	STORAGE						
13	WAIT TRANS.						
14	TO STORAGE AT ASSEMBLY AREA					355	
15	STORAGE						
16	TO BIN STORAGE					25	
17	BARREL TO BIN					3	
18	WAIT ASSEMBLY						
	TOTALS	1	9	8		527	

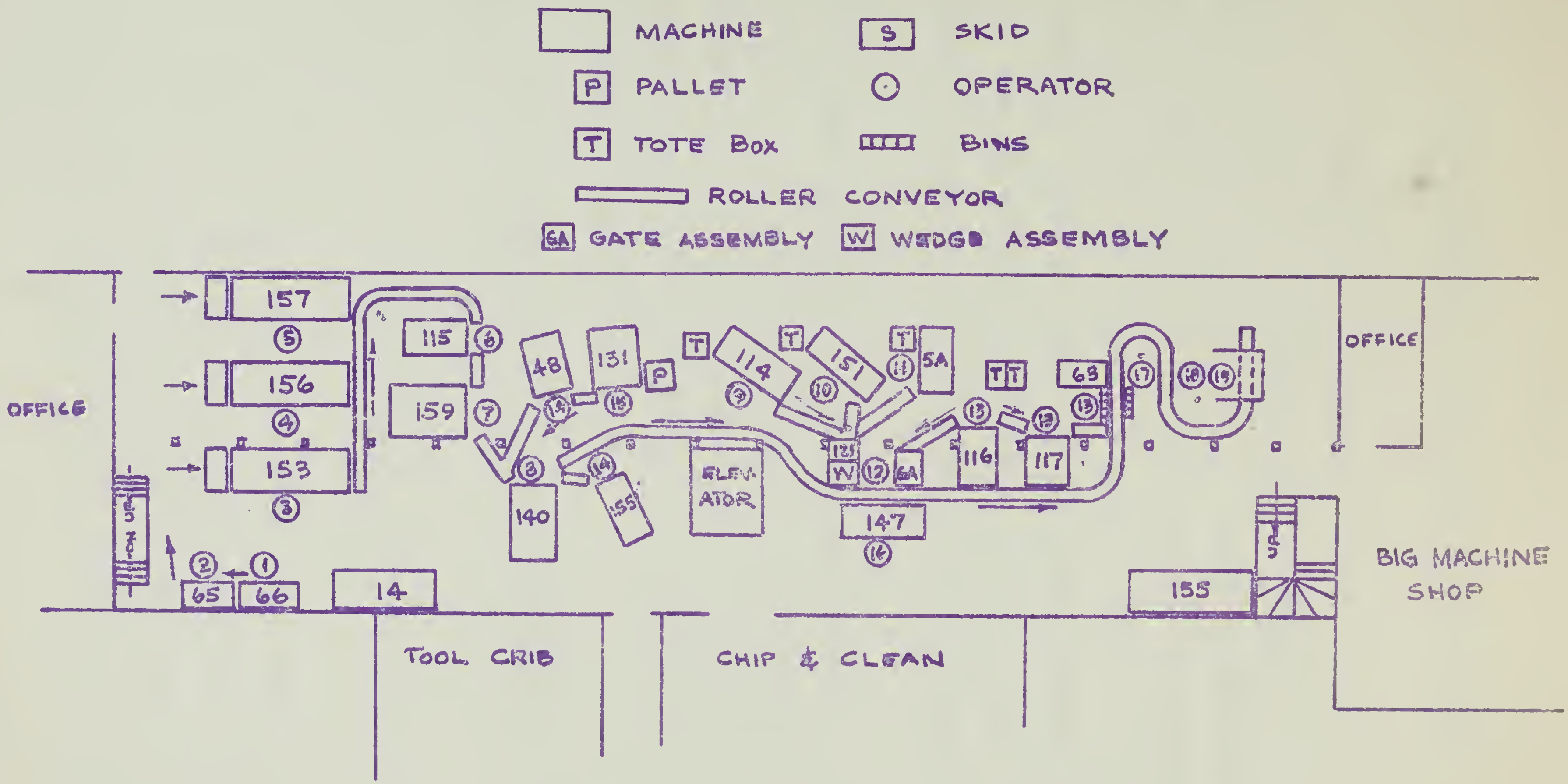
PRESENT METHOD CONT. V

NO	DESCRIPTION	○	o	▽	□	DIST	HRS / 100 PCS
	—STEM NUT—						
1	STORAGE IN BASEMENT BIN						
2	TO BARREL					3	
3	TO STORAGE IN SHOP					91	
4	STORAGE						
5	TO MACH. 116					19	
6	STORAGE						
7	TO MACH. TABLE					4	
8	WAIT MACH.						
9	TAP						1.30
10	TO BARREL					4	
11	WAIT COMPL. OF LOT						
12	WAIT TRANS.						
13	TO STOR. AT ASS'Y AREA					227	
14	STORAGE						
15	TO GATE ASS'Y AREA					49	
16	WAIT ASSEMBLY						
	TOTALS	1	7	8		397	
	—FOLLOWER PLATE—						
1	STORAGE IN BASEMENT						
2	TO STORAGE IN MACHINE SHOP					115	
3	STORAGE						
4	TO MACH 116					15	
5	WAIT MACHINE						
6	TO MACH. TABLE					5	
7	BORE						.45
8	TO TOTE BOX					4	
9	WAIT COMPLETION OF LOT						
10	WAIT TRANS.						
11	TO STORAGE IN BASEMENT					125	
12	STORAGE IN BIN						
13	TO BARREL					4	
14	TO ASS'Y AREA					331	
15	BARREL TO BIN					4	
16	WAIT ASSEMBLY						
	TOTALS	1	8	7		603	

NO	DESCRIPTION	○	o	▽	□	DIST	HRS / 100 PCS
	—WRENCH NUT—						
1	STORAGE IN BASEMENT BIN						
2	HOOK ON WRENCH NUT						
3	CARRY TO DIP TROUGH						
4	IMMERSE IN PAINT						
5	HANG ON RACK						
6	DRAIN						
7	INSPECT						
8	TO BIN						
9	STORAGE						
10	BIN TO BARREL						
11	TO STOR. AT VALVE ASSY AREA						
12	WAIT ASSEMBLY						
	TOTALS	3	4	4	1	370	
	—PURCHASED PARTS—						
	PEGS & STRAPS						
1	STORAGE IN BASEMENT						
2	TO GATE ASS'Y AREA					381	
3	WAIT ASSEMBLY						
	TOTALS (FOR 2 PARTS)		2	4		762	
	PACKING						
1	STORAGE IN BASEMENT						
2	TO BENCH					55	
3	CUT IN STRIPS						
4	TO VALVE ASS'Y AREA					325	
5	WAIT ASSEMBLY						
	TOTALS	1	2	2		380	
	COVER BOLTS, NUTS & WASHERS STUFFING BOX BOLTS & NUTS COVER GASKETS, PIPE PLUGS TOP NUTS, STUFFING BOX GASKETS						
1	STORAGE IN BASEMENT						
2	TO VALVE ASS'Y AREA					375	
3	WAIT ASS'Y						
	TOTALS (FOR 9 PARTS)		9	18		3375	

PRESENT METHOD - CONCLUDED

No	DESCRIPTION	O	o	▽	□	DIST	HRS / 100 PCS
	— ASSEMBLY —						
1	CASE FROM STORAGE TO ASSEMBLY BENCH					8	
2	GATE ASSEMBLY TO CASE					8	
3	SEAT GATE ASS'Y IN CASE						
4	COVER GASKET FROM STORAGE TO CASE					7	
5	POSITION GASKET ON CASE						
6	COVER FROM STOR. TO CASE					12	
7	POSITION COVER ON CASE						
8	STEM FROM STOR. TO ASS'Y					7	
9	POSITION STEM IN ASS'Y						
10	COVER NUTS & BOLTS FROM STORAGE TO ASSEMBLY					7	
11	POSITION & TIGHTEN NUTS & BOLTS IN ASSEMBLY						
12–19	GET REMAINING PARTS FROM STORAGE					56	
20–27	ASSEMBLE REMAINING PARTS						
28	WAIT TEST						
29	TO TEST STAND					10	
30	TEST & ADJUST AS REQ'D						
31	INSTALL PIPE PLUG						
32	TO PAINT RACK					12	
33	WAIT PAINT						
34	PAINT						
35	WAIT DRY						
36	TO STORAGE IN SHIP. AREA					100	
37	WAIT SHIPPING						
	TOTALS	15	17	4	1	227	785



LAYOUT OF PROPOSED PRODUCTION LINE
IN OLD MACHINE SHOP

SCALE 1" = 20'

APPENDIX 4.3

APPENDIX 4.4

ACTION NECESSARY TO ESTABLISH PRODUCTION LINE

In designing the production line for the manufacture of List 13A 6-inch mechanical joint valves certain assumptions have been made and methods changes incorporated. The purpose of this appendix is to list and explain the actions considered necessary to establish the production line. Such actions will be separated into two classes - essential and desirable. Essential items are those minimum actions necessary to put the line into operation with some economy. Desirable items are those refinements that would permit increased operating economies.

Essential action necessary to operate production line:

i) Rearrange machinery as indicated in Appendix 4.3. It is recommended that the line and counter-shafting drives be replaced with individual electric motor belt drives. This would provide additional flexibility for future rearrangements.

ii) Relocate existing weight-lifting devices and provide additional devices as necessary.

iii) Install roller conveyor. About 250 feet of various sizes are required.

iv) Provide fixtures for the following operations and machines:

a) Drill ends of cases with Machine No. 115

b) Mill neck of 4" and 8" valve cases with Machine No. 159

c) Mill neck of 6" valve cover with Machine No. 131

d) Drill neck of cases and covers alternately with Machine No. 140 in a fixture similar to one now in use for cases only.

v) Provide new device for attaching plows to wedge. This should be a clamp-press device either hydraulic or manually operated to attach two plows simultaneously instead of one at a time and to replace the air hammer now used.

vi) Provide dual purpose machine and tool to replace Machine No. 125 for drill and tap gates.

vii) Eliminate the bore operation on the follower plate by improving pattern design.

viii) Provide gravity feed bins for small parts at ass@mbly positions.

ix) Provide pneumatic wrenches at assembly positions. They should be suspended overhead on springs. Such wrenches would replace the wrenches now in use where the hose on the floor creates a hazard. Now, when not in use, the wrench is placed on the assembly bench and never is where it is needed next.

x) Provide pneumatic wrench at test stand to replace the present time-consuming method of running gate up and down with hand wrench.

xi) Provide quick-acting coupling device for attaching hose to valve at test stand.

xii) Raise test stand to waist height to eliminate stoop.

xiii) Install spray booth with adequate ventilation at end of line to replace paint brush.

xiv) Determine production time standards for the operations where no standard exists and where a new method is to be used.

xv) Move machines not essential to manufacture of 4 - 12-inch valves to Big Machine Shop.

Desirable action to obtain additional economies:

i) Extend foundry roller conveyor and shakeout into Brass Foundry. Relocate Chipping and Cleaning. Install mechanized, conveyor-type dipping process in Brass Foundry. Construct truck ramp between Brass Foundry and Old Machine Shop. Relocate Brass Foundry in new building or buy all brass castings. Move Foundry and Machine Shop offices into present Chip and Clean Room.

ii) Provide access through wall at northwest corner of Old Machine Shop to loading platform. Extend railroad siding, if necessary.

iii) Combine seat ring machine operations, now performed on two machines - Nos. 65 and 66, into an operation capable of completion on one machine.

iv) Replace radial drill, Machine No. 158, with drill press, and replace separate drill and tap with dual purpose drill and tap.

SUMMARY OF OPERATIONS - LIST 13A - 6" M/J

PIECE	OPERATION No.	OPERATION DESCRIPTION	HRS PER PIECE	OPERATIONS PER VALVE	OPERATORS REQ'D	MACHINE NO.	OPERATOR NO.	SEQUENCE (EACH UNIT EQUALS .06 HRS.)
CASE	1	THD. RING	.028	2	1	66	1	
"	2	CHAMF. RING	.014	2	1/2	65	# 2	
"	3	RING	.194	1	3	153 156 157	3,4,5	
"	4	DRILL ENDS	*.060	1	1	115	6	
"	5	MILL NECK	.063	1	1	159	7	
"	6	DRILL NECK	.027	1	1/2	140	8	
GATE	7	FACE & RING	.094	2	3	5A 151 114	9,10,11	
"	8	DRILL & TAP	.015	2	1/2	125	12	
"	9	TAP STEM NUT	.013	1	1/5	116	13	
"	10	ASSEMBLE WEDGE & PLOWS	.030	1	1/2	W	12	
"	11	ASSEMBLE GATES	*.030	1	1/2	GA	12	
COVER	12	DRILL & TAP PLUG HOLE	.022	1	1/3	158	14	
"	13	MILL NECK	*.063	1	1	131	15	
"	14	BORE & C.BORE	.028	1	1/2	48	14	
"	15	DRILL NECK	*.030	1	1/2	140	8	
STEM	16	MACHINE	.056	1	1	147	16	
STUFFING BOX	17	BORE	.012	1	1/5	116	13	
"	18	LAP OFF	.015	1	1/4	117	13	
FOLLOWER GLAND	19	BORE	.014	1	1/4	63	13	
VALVE	20	ASSEMBLE	*.030	1	1/2		17	
"	21	TEST	*.090	1	1 1/2		17,18	
"	22	PAINT	*.060	1	1		19	

* ESTIMATED STANDARD TIME
\# SERVES AS UTILITY OPERATOR

PROPOSED FLOW CHART OF [illegible] METHOD FOR THE MANUFACTURE OF [illegible] VALVES

SUMMARY

PIECE	○	∘	▽	□	DIST
CASE	5	4	4	1	483
COVER	5	5	4	1	438
GATE & GATE ASSEMBLY	5	5	4	2	365
GATE RING		1	1		292
WEDGE & PLOW ASSEMBLY	2	6	5		665
PEGS & STRAPS		1	1		290
STEM NUT	1		1		
STEM	1	1	1		9
SEAT RING	3	4	3	1	188
FOLLOWER GLAND	1	1	1		3
STUFFING BOX	2		1	2	
WRENCH NUT			1		
PACKING	1	1	1		185
MISC. PURCH. PARTS (8)		8	8		1780
ASSEMBLY	16	1	3	1	232
TOTALS	42	36	35	8	4930

— COVER —

No	DESCRIPTION	○	∘	▽	□	DIST
1	WAIT DIP					
2	TO DIP					
3	DIP					
4	TO DRAIN					
5	DRAIN					
6	TO PALLET					
7	WAIT COMPLETION OF LOT					
8	TO MACHINE SHOP					
9	WAIT MACHINE					
10	MILL NECK					
11	BORE & COUNTERBORE					
12	INSPECT					
13	DRILL NECK					
14	DRILL & TAP PLUG HOLE					
15	TO ROLLER CONVEYOR					
16	SEE ITEM NO 3 - ASSEMBLY					
	TOTALS	5	5	4	1	438

— CASE —

No	DESCRIPTION	○	∘	▽	□	DIST
1	WAIT DIP					
2	TO DIP					5
3	DIP					
4	TO DRAIN					4
5	DRAIN					
6	TO SKID					9
7	WAIT COMPLETION OF LOT					
8	TO MACHINE SHOP					465
9	WAIT MACHINE					
10	RING					
11	INSPECT					
12	DRILL ENDS					
13	MILL NECK					
14	DRILL NECK					
15	SEE ITEM NO 1 - ASSEMBLY					
	TOTALS	5	4	4	1	483

NOTE: OPERATION TIMES FOR THIS METHOD ARE ASSUMED TO BE THE SAME AS THE PRESENT METHOD UNLESS METHOD HAS BEEN CHANGED.

— GATE & GATE ASSEMBLY —

No	DESCRIPTION	○	∘	▽	□	DIST
1	WAIT DIP					
2	TO DIP					
3	DIP					
4	TO DRAIN					
5	DRAIN					
6	TO TOTE BOX					
7	WAIT COMPLETION OF LOT					
8	TO MACHINE SHOP					
9	WAIT MACHINE					
10	FACE & GROOVE					
11	INSPECT					
12	RING					
13	INSPECT					
14	DRILL & TAP PEG HOLES					
15	TO GATE ASS'Y BENCH					
16	ASSEMBLE GATES					
17	SEE ITEM 1 - ASSEMBLY					
	TOTALS	5	5	4	2	365

APPENDIX 4.6

PROPOSED METHOD - CONT. ii

NO	DESCRIPTION — SEAT RING —	O	o	▽	□	DIST
1	TO MACHINE SHOP					155
2	WAIT MACHINE NO 66					
3	TURN & FACE					
4	INSPECT					
5	THREAD & CHASE					
6	TO MACHINE NO 65					4
7	WAIT MACH.					
8	CHAMFER					
9	TO TOTE BOX					4
10	WAIT COMPLETION OF LOT					
11	TO ITEM 10 - CASE					25
	TOTALS	3	4	3	1	188
14	WEDGE & PLOW ASS'Y	—	—	—		
1	WAIT DIP					
2	TO DIP					5
3	DIP					
4	TO DRAIN					5
5	DRAIN					
6	TO TOTE BOX					6
7	WAIT COMPLETION OF LOT					
8	TO MACHINE SHOP					345
9	WAIT ASSEMBLY					
10	PLOWS FROM BASEMENT					300
11	WAIT ASSEMBLY					
12	ASSEMBLE PLOWS TO WEDGE					
13	TO GATE ASS'Y BENCH					4
14	ITEM 16 - GATE & GATE ASS'Y					
	TOTALS	2	6	5		665
—	— STUFFING BOX —	—	—			
1	WAIT MACH. 116					
2	BORE					
3	INSPECT					
4	LAP OFF					
5	INSPECT					
6	ITEM 8 - ASSEMBLE					
	TOTALS	2		1	2	
—	— ALL OTHER PARTS —	—				
1	FROM BASEMENT					
2	WAIT ASSEMBLY					

NO	DESCRIPTION	O	o	▽	□	DIST
	— STEM NUT —					
1	WAIT MACHINE					
2	TAP					
3	ITEM 16 GATE & GATE ASS'Y					
	TOTALS	1		1		
	— STEM —					
1	WAIT MACHINE					
2	MACHINE					
3	TO ASSEMBLY LINE					9
4	ITEM 5 - ASSEMBLE					
	TOTALS	1	1	1		9
	— PACKING —					
1	FROM BASEMENT					185
2	WAIT INSTALLATION					
3	CUT TO LENGTH					
4	ITEM 9 - ASSEMBLE					
	TOTAL	1	1	1		185
	— ASSEMBLE —					
1	SEAT GATE ASS'Y IN CASE					
2	POSIT. GASKET ON CASE					
3	POSIT COVER ON CASE					
4	POSIT NUT & BOLTS IN ASS'Y					
5	POSIT STEM IN ASS'Y					
6	TIGHTEN NUTS & BOLTS					
7	POSIT STUFFING BOX GASKET					
8	POSIT STUFFING BOX					
9	POSIT PACKING					
10	POSIT FOLLOWER GLAND					
11 TO 14	ASSEMBLE REMAINING PARTS (4)					
15	TEST					
16	ASSEMBLE PIPE PLUG					
17	PAINT					
18	WAIT DRY					
19	WAIT TRANS					
20	TO SHIPPING AREA					232
21	WAIT SHIPPING					
	TOTALS	16	5	7	2	232
—	— FOLLOWER GLAND —	—	—			
1	WAIT MACHINE 63					
2	BORE					
3	TO ASSEMBLY - ITEM 10					3
	TOTALS	[illegible]	[illegible]			[illegible]

APPENDIX 5.1

OPERATION SAMPLING

A TECHNIQUE FOR DETERMINING PRODUCTION TIME STANDARDS

The Operation Sampling technique for determining production time standards is a development of the Snap Method of Time Study as originated in England by Tippitt and an adaptation of the Work Sampling technique in this country to the overall problem of setting production time standards. Tippitt's method and the Work Sampling technique (or Ratio Delay) are restricted simply to the determination of allowances for delays in production. Development of the Operation Sampling technique is attributed to Professor H. W. Martin and the Management Engineering staff at Rensselaer Polytechnic Institute. It is suggested as a highly practical statistical technique that is productive of more accurate results at less cost than ordinary stopwatch methods.

The Operation Sampling technique consists of making a large number of random observations of one or more operators on one or more operations. For each operator observed a record is maintained of the cumulative number of times he was observed performing each element, including both working and non-working elements. From the percentage occurrence of each of the observed and recorded elements the percentage of time actually spent in performing each element can be obtained. By maintaining production records during the period of observation and by applying the percentage occurrence of each recorded element a standard time can be computed.

Operation Sampling as a technique has several unique advantages over the stopwatch method of time standard setting. Some of the ad-

vantages are:

i) More information pertinent to the entire operation can be obtained through the use of Operation Sampling. By making random observations distributed over all hours of the day and week and over a long period of time a more representative and reliable sample of work will be obtained.

ii) Costs of Operation Sampling studies have been reported at from one-third to one-sixth of the costs of continuous observation type studies.

iii) Operation Sampling provides an opportunity to observe and evaluate the operation of a department as a whole.

iv) The observer's time may be interrupted at any time without affecting the study. Taking studies is not tedious for the observer.

v) The accuracy of results can be determined mathematically for any number of observations.

vi) There have been fewer objections from operators under study. No stopwatch is used and the operator is not observed closely for long periods of time. There results less distortion in operators' normal work routine.

vii) By classifying non-working elements, Operation Sampling assists materially in determining allowance standards where the stop-watch method normally could not do so. Judgment is reduced and the objectivity of the study is increased.

viii) By taking many observations distributed over all hours of the day and week, the observations resulting are more representative of the work actually being performed. Consequently the effects of fatigue are included conveniently in the standard as computed by Operation Sampling.

However, Operation Sampling is not without its disadvantages. Some disadvantages are:

i) It is not adaptable to rapid rate-setting for new unstudied operations.

ii) Operation Sampling does not eliminate the objection of labor to any managerial method or device that might be used for a speed-up.

iii) Operation Sampling has not as yet eliminated the necessity for effort rating. It is possible, however, that with a "statistically adequate" sample, effort rating may be ignored.

SO NUMBER	QUAN	SIZE	LIST NO.	DESCRIPTION	CUSTOMER	DITTO No.	SHIPMENTS DATE & QUANTITY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
7.1																			

198894	4120	4-14" L13A Single Sq. Bo. 10" IBBL TRS Adj stop gate pres 5# Cyl. pres. 50#	1-4-2	4/30	Bloomington, Ill.
200234	4106	2-14" L13A Flg OL OS&Y W/Flrstd & Ext stem	1-5-1	5/21	Roanoke Rapids, N.C.
200324	4111	1-14" L13A Hub OL BGITGC TRS	1-4-43	5/15	Gardena, Cal
200284	4138	1-14" L13A Flg OL SBP Spot face	1-5-2	5/30	Hemet, Cal.
200834	BM4165	1-14" L13A Hub OL	1-5-3	5/28	Grand Forks, N.D.
197987	BM-16304S-52	1-16" L13A Single Sq Bo Flg OL OS&Y W/SMO-7 & Cleanout pockets (2)	1-2-2	4/16	Peekskill, N.Y.
198014	BM-16304S-11	2-16" L13A Do Sq Bo Flg F. 17" W/Motor	1-4-3	4/30	Macon, Ga.
198614	BM-16304S-12	1-16" L13A Do Sq Bo Flg. F. 17" W/Motor TRS	1-4-4	4/30	Macon, Ga.
198913	BM-16304-53	4-16" L13A Flg 9" IBBL TRS Special eyenut	1-4-5	4/28	Darby, Pa.
198807	BM-161201-1	1-16" L12 Hub OR BGGC TRS	1-3-24	3/31	Biddeford, Me.
199959	BM-161104-11	1-16" L11 Flg OL TRS F. 10½"	1-5-4	5/21	Biddeford, Me.
200005	BM-161104-13	1-16" L11 Flg OL SG W/Flrstd	1-4-6	4/16	Westfield, N.J.
200084	BM-16310-14	4-16" L13A M.J. OR SGITGC	1-3-30	3/31	Indianapolis, Ind.
199989	BM-16304-54	4-16" L13A Flg OR CWD Specs. W/Nut	1-4-7	4/ 23	Cleveland, Ohio
200069	BM4100	8-16" L15 Do Sq Bo OL Flg SGITGC SBP 4" B/P Gears right Forged stems. LA Specs.	1-5-5	5/28	Los Angeles, Cal.
200221	4115	1-16" L13A Flg OL BG W/Ind. 1 on 4/23	1-4-8	4/23	Yakima, Wash.
200234	4105	4-16" L13A Flg OL OS&Y W/Flrstd & Ext stem	1-5-6	5/21	Roanoke Rapids , N.C.
200234	4109	4-16" L13A Flg OL SG OS&Y Pressure Bush.	1-5-7	5/21	Roanoke Rapids, N.C.
200333	BM4124	1-16" L13A M.J. OL BGGC W/Acc. TRS	1-4-9	4/30 MUST	Lansing, Mich.

TAPPING [illegible] FOR MAY   [illegible] A/20 ASSEMBLY

	FIN.	ORDERS		STOCK CHECK				M.S.	BACKLOG			MAY			NOTES
				INV.		SHORT									
	INV.	CUST.	C.S.	Fr.	Bk.	Fr.	Bk.	PROGRESS	VOL	VOR	ONLY	VOL	VOR	ONLY	
[illegible]	7														
[illegible]	0														
[illegible]	1	1							1						
[illegible]	2														
[illegible]	1	1							1						
[illegible]	1	11	4						4		7				
[illegible]	5	1	2							1*					199184 Class 150 TP unmach. Mach. ID 7-5/8 Concentricity dia mach socket 8-1/8
[illegible]	1	2	6								1	1			
[illegible]		3	4							1*	2**				*1-200227 - 3/31 **2-200211 - 3/31
[illegible]	3		2												
[illegible]	1														
[illegible]		1								1					1-197847 - 11/30/53
[illegible]	3														
[illegible]		1								1					
[illegible]	20	40	10						3	7	6	12	2	10	

7.2D

SIZE 6"

DESCRIPTION / DATE	B/L	C/M	C/S	3/18	3/29	30	31	4/1	2	5	6	7	8	9	12	13	14	15	16	19	20	21	22	23	26
Hubs OL	101 55	5	50 50	112 47	100		12		12	100 50	23 39	29			50 25		36 73	34 46			18				50
Hubs OL SBP			1												1										
Hubs OL Oil																									
Hubs OR	208	75	25	81	100				34	46 50	25	43			50 75	6		2		50	7				100
Flange OL	42	18	80	51	60	40	40		18	25		5	1		4					60	4				
Flange OL SBP			12		12				12																
Flange OR	5																								
Hub & Flg. OL	10		13															2		10					
Hub & Flg. OR	5																								
Flg.& MJ. OL	2		10												19	2					20				
Flg.& MJ. OR																									
Tapping OL	15	21	37		20		25		23						20						40				30
Tapping OL SBP	6		6		6			5	7											6					
Tapping OL Oil	10																				12				
Tapping OR	35	12			20		3		27			4								20	2				20
Screw End OL	10		11																	25					
Screw End OR							10																		
OS&Y Flg. OL	2	16	8		4		10					4								25	2				

SCHEDULE NO 265 FOUNDRY DATE ______ MACHINING DATE ______ ASSEMBLY DATE Wk 4/23 FORM M-529

BASED ON ___ HYDRANTS PER DAY

SIZE 4"

S.O.	SHIPPING LOCATION	QUANTITY	HOSE NOZZLE 2 1/2	HOSE NOZZLE SPECIAL	STEAMER NOZZLES 5"	4 1/2"x5"	4"x5"	4 1/2"x4 1/2"	4 1/2"	4"	SPECIAL	STEMS OPEN RGT.	STEMS OPEN LFT.	HOSE CAPS 1 1/8"	1 1/4"	1 3/8"	1 1/2"	SPECIAL
200673	Abbeville, La.	2	NS										2			4		
200708	San Carlos, C.S.	10	NS										10	20				
200744	Marion, Mass.	3	172										3		6			
200745	Marion, Mass.	4	172										4		8			
200727	Quincy, Mich.	2	NS									2					4	
200999	Cheyenne, Wyo.	10	175									10			20			
200855	Garden City, N.Y.	18	28									18						36
200955	Northfield, Minn.	1	NS										1	2				
201003	Rockton, Ill.	1	NS										1			2		
200778	Aberdeen, Miss.	1	NS							1			1			2		
☆ 200641	Hazleton, Pa.	1	319							1			1					2
200645	Aberdeen, Miss.	1	NS							1			1			2		
200739	Western Springs, Ill.	1	NS					1					1				2	
200854	Fairchance, Pa.	1	185					1					1				2	
200732	Clifton, N.J.	4	86					4				4						8
200996	Utica, N.Y.	3	NS					3					3					6
200733	Utica, N.Y.	3	NS					3					3					6
200926	Utica, N.Y.	2	168					2					2	4				
200729	Pompton Plains, N.J.	4	NS			4							4				8	
200798	Dyersburg, Tenn.	2	NS			2							2		4			
200798	Dyersburg, Tenn.	1	NS			1							1		2			
201020	Rockaway, N.J.	2	NS			2							2				4	
200856	Pittsburg, Pa.	2	13			2							2			4		
200731	Clifton, N.J.	4	30			4							4	8				
200747	Andover, Mass.	3	NS			3							3				6	
200632	Winthrop, Me.	1	NS			1							1				2	
201035	Auburn, Me.	6	NS			6						6				12		
☆☆ 201037	Cohoes, N.Y.	2	NS							2			2	4				
201077	Rochester, N.H.	20	NS			20						20						40
201076	Rochester, N.H.	4	NS			4						4						8
201052	Clifton, N.J.	4	30			4							4	8				
201053	Clifton, N.J.	4	86					4				4						8
201070	Lakeland, Fla.	6	641			6							6					12
Totals	TOTAL	133				59		18		5		68	65	46	40	26	28	126
#41-2	ON HAND																	
#1-9	TOTAL REQ																	

S.O.	4" STEAMER CAPS 1 1/8"	1 1/4"	1 3/8"	1 1/2"	SPECIAL	5" STEAMER CAPS 1 1/8"	1 1/4"	1 3/8"	1 1/2"	SPECIAL	OPERATING NUTS 1 1/8"	1 1/4"	1 3/8"	1 1/2"	SPECIAL	UPPER SECTIONS 2-2 1/2	2-2 1/2, 1-4	2-2 1/2, 1-4 1/2	2-2 1/2, 1-5
200673													2			2			
200708											10					10			
200744												3				3			
200745												4				4			
200727														2		2			
200999												10				10			
200855															18	18			
200955											1					1			
201003													1			1			
200778			1										1				1		
☆ 200641					1										1		1		
200645			1										1				1		
200739				1										1				1	
200854				1										1				1	
200732					4										4			4	
200996					3										3			3	
200733					3										3			3	
200926	2										2							2	
200729									4					4				4	
200798							2					2						2	
200798							1					1						1	
201020									2					2				2	
200856								2					2					2	
200731						4					4							4	
200747									3					3				3	
200632									1					1				1	
201035								6					6					6	
☆☆ 201037	2										2						2		
201077										20					20			20	
201076										4					4			4	
201052						4					4							4	
201053					4										4			4	
201070										6					6			6	
TOTAL	4		2	2	15	8	3	8	10	30	23	20	13	14	63	51	5	77	
ON HAND																			
TOTAL REQ																			

S.O.	BOTTOM SECTIONS 4" BELL	4" FLG.	6" BELL	6" FLG.	4" UNIV.	6" UNIV.	4" MECH.	6" MECH.	4" BELL LUG	6" BELL LUG	SPECIAL	EXTENSIONS 6"	12"	18"	24"	30"	36"	42"	48"	54"	BOTTOM PLATES WITH DRIP	WITHOUT "	SEWER CONN.
200673	2														2						2		
200708	10															10						10	
200744			3															3			3		
200745			4															4			4		
200727	2																		2		2		
200999		10																	10		10		
200855				18															18		18		
200955	1																			1	1		
201003		1										1								1	1		
200778			1													1					1		
☆ 200641	1																1				1		
200645							1										1				1		
200739							1								1						1		
200854	1															1					1		
200732			4																4		4		
200996			3																3		3		
200733			3																	3	3		
200926			2																	2	2		
200729			4														4				4		
200798			2														2				2		
200798			1															1			1		
201020			2														2				2		
200856				2															2		2		
200731			4																	4	4		
200747			3																	3	3		
200632			1									1								1	1		
201035			6																	6		6	
☆☆ 201037			2																2		2		
201077			20																	20	20		
201076			4																	4	4		
201052			4																	4	4		
201053			4																4		4		
201070			6												6						6		
TOTAL	17	11	83	20			2					2			9	12	10	8	45	49	117	16	
ON HAND																							
TOTAL REQ																							

#124-1	#52-17	#6-6
#132-1	#4-9	#13-2
#32-8	#29-3	#5-24

PUR. PARTS: FOLL. STUD (2) | FOLL. STUD NUT | PACKING | HD. PLATE GAS. | HD. PLATE BLT'S SHORT | HD. PLATE BLT'S LONG | HEAD NUTS | COLLAR SET SCREWS | NOZZLE CHAIN | OPERATING ROD TOT. | FLANGE BLT'S | FLANGE NUTS | FLG. GASKET | COUPLING TOT. | COUPLING PINS | GATE PINS SHORT | GATE PIN LONG | GATE COTTER PIN | GATE STUDS | GATE NUTS | GATE ARMS | GATE RUBBER | DRIP RUBBER | DRIP WASHER | DRIP BOLT | BASE FLG. BLT'S | BASE FLG. NUTS | STAND ITEMS | DOME | LOCK RING | SLEEVE | FOLL PLATE | FOLL GLAND | HEAD PLATE | DEFLECTOR | COLLAR | EXT. RODS | EXT. ROD EXT. | STEM NUT SHORT | STEM NUT LONG | GATE PLATE | GATE WASHER | SEAT RING | DRIP HOLDER | DRIP BARREL | COUPLINGS (4) | SPECIAL STEAMER NOZZLE

SPECIAL STEAMER CAPS: 7-4"-1 9/16 P. | 8-4"-1 1/16 P. | 24-5"-1 5/16 P.

SPECIAL HOSE CAPS: 36-2 1/2"-7/8x1 5/16 | 14-2 1/2"-1 9/16 P. | 16-2 1/2"-1 1/16 P. | 48-2 1/2"-1 5/16 P. | 12-2 1/2"-1 5/8 P.

SPECIAL OPER. NUTS: 18-7/8x15/16 N.R. | 7-1 9/16 P.O. | 8-1 1/16 P.O. | 24-1 5/16 P.O. | 6-1 5/8 P.O.

Str. Caps

6-5"-1 5/8 P.

7.4

☆ Hose + Str. Noz. Caps to be fitted with both Octagon + Pent. Oper. Nuts

☆☆ Str. Caps as per Sketch S-374

IRON AND BRASS FOUNDRY PRODUCTION SCHEDULE FOR WEEK ENDING MARCH 19, 1954

DATE	1	1A	2	3
3/15	NOT OPERATING	12" FLG CASE 12" HUB CASE	8" COVERS	8" STUFFING BOX 4" GATES 6" STEM
3/16	8" FLG CASE PM	40-8x6 FRONT 20-12x8 FRONT	6" COVERS	6" FOLLOWER PLATE 8" STEM
3/17	ST. PATRICK'S DAY			
3/18	4" TRANSITE CASE PM	12" MECH JT AM	4" COVERS	6" GATES 6" STEM
3/19	OPEN DAY	6" FLG CK CASE AM	E-102 ELBOW 4" MECH JT CASE 10" GATE BR INCL	8" WEDGE 6" STEM

	1B	2B	3B	4B
3/15	2" CASE RING	12" GATE RING	6" FOLL GLAND GG-1 FOLL GLAND	2" STEMS
3/16	4" STEMS	2" CASE RINGS	4" STEM NUTS	100-BX-4 STUFF BOX 100-BX-3 " " 200-BX-2 " "
3/17	ST. PATRICK'S DAY			
3/18	2" GATES	10 & 12 HINGE 6" HINGE	8" STEM NUTS	100-BY-3 FOLL GLAND 100-BZ-3 COVER NUT
3/19	300-2" WEDGE	10" GATE RING 2" FOLL GLAND	8" TAP CASE RING	100-BY-2 FOLL GLAND 100-BZ-2 COVER NUT

FOUNDRY PRODUCTION SCHEDULE

____________________ 19 ______

SIZE	LIST	DESCRIPTION	STD. HRS.	ACT. HRS.	MLD. STD.	MLD. ACT.	% OF PERF.

CONCENTRATION

3/23			
198223	1-48" L13A Flg BGGC TRS 8" BP	1-4-1	Oakland
198833	1-18" #13A Flg F in V SG LH-	1-3-1	New Chesterfield
200017	1-16" L13A Hub BGGC 3" BP TRS LH	1-3-26	Columbus
200017	1-20" L13A Hub BGGC 3" BP TRS LH	1-3-35	Columbus
198832	1-20" L12 Flg SG LH	1-3-2	St. Louis
3/24			
200240	2-16" L13A Hubs LH	1-4-11	Waukegan
200471	3-16" L13A Hubs RH	1-4-17	Mt. Kisko
200488	1-16" L13A Hub LH	1-4-19	El Segundo
199453	1-24" L13A Flg BGETGC 4" BP TRS LH	1-3-17	Macon
198354	1-24" L13 Do Sq Bo Hub W/Lugs RH BGETGC 4" BP TRS	1-2-17	CWD
3/25			
199553	6-16" L12 Flg SG SBP LH	1-3-16	Glendale
199155	1-24" L13A Flg BGETGC 4" BP TRS RH	1-3-7	Louisville
3/26			
199155	1-24" L13A Flg BGETGC 4" BP TRS RH	1-3-7	Louisville
199553	8-16" L12 Flg SGGC SBP LH	1-3-15	Glendale

Daily Assembly and Test Report

Date 5-22-54

er No.	Size Valve	List	TYPE	Number Assembled	Number Tested	Number Rejected	Reason for Reject	Total Good	√
99362	5"	90A	48 Ext 6 Bell 5 St	2	2			2	
99331	5"	90A	42 Ext 6 Bell 5 St	1	1			1	
99361	14	13a	Hub-OL-BG ITGC TSR	3	3			3	
99482	16	13a	Flg. 9' 1BBL TRS	2	2			2	
			Totals						

Signed W F D.

FORM NO. M-537 5M 7-53

7.8

OPERATOR PRODUCTION RECORD

NAME						CLOCK NO.		MACH. NO.		DATE
ORDER NO.	SIZE	LIST	PART NAME	OPERATION	OPER. NO.	PCS. SCRAP	PCS. GOOD	STND. HRS PER PC.	TIME STNDRD	TIME ACTUAL

PRODUCTION MATERIAL REQUISITION

FORM P-303 1M-7-53

PART NAME	PART NO.	USED ON	USED ON
MATERIAL SPECIFICATION	DATE		
ALTERNATE PART	ENG. CHANGE NO.	UNIT OF MEASURE	
DELIVER TO	ACCOUNT NO.	AVG. MO. USE / MIN. / MAX.	

DATE	QUANTITY	REQUIRED DELIVERY	APPROVED		PER MONTH	DATE	P.O. NO.	QUANTITY	VENDER	REMARKS

8.2

FORM P-303 1M-7-53

PART NAME	PART NO.	USED ON	USED ON

MATERIAL SPECIFICATION	DATE

ALTERNATE PART	ENG. CHANGE NO.	UNIT OF MEASURE

DELIVER TO	ACCOUNT NO.	AVG. MO. USE	MIN.	MAX.

DATE	QUANTITY	REQUIRED DELIVERY	APPROVED		PER MONTH	DATE	P.O. NO.	QUANTITY	VENDER	REMARKS

8.3

RENSSELAER VALVE CO.

STOCK RECORD

FORM P-339 1M 7-53

ON ORDER			RECEIPTS			DELIVERIES				DELIVERIES			
DATE	ORDER No.	QUANTITY	DATE	ORDER No.	QUANTITY	DATE	DEPT. No.	QUANTITY	BALANCE	DATE	DEPT. No.	QUANTITY	BALANCE

MAX. BAL.	RACK	SECTION	ITEM
MIN. BAL.			

FORM P 337-R 25M 1-54 RP

Requisition on Stock Room

Dept.______________________ Date______________

DEPT. TO BE CHARGED FOR MATERIAL DELIVERED

Quantity	Description	Unit Cost	Total
	For Assembly Order No.__________		

*Approved By*______________________ *Signed By*______________________

8.4

FORM P-301 2000 SETS 1-54

ORIGINAL—TO BE SENT TO PURCHASING DEPT.

REQUISITION ON PURCHASING DEPT.

P. O. No.

DATE OF REQ.

FOR DEPT.

SHIP VIA

USED FOR	STOCK		EQUIPMENT	S. O. NUMBER	LAST PURCHASE RECORD			ON HAND	DATE WANTED
	PRODUCTION	MAINT.			DATE	QUANT.	COST		

QUANTITY	DESCRIPTION	UNIT COST	TOTAL COST
	DO NOT SPECIFY MORE THAN ONE CLASS OF MATERIAL ON THIS REQ.		

ALL REQ. MUST BE APPROVED BEFORE SENDING TO PURCH. DEPT.

PURCHASED FROM SIGNED BY

APPROVED BY

8.5

Rensselaer Valve Company

DAILY SHIPPING REPORT

Date____________________

ty	Item	S. O. No.	Shipped to	Via Carrier	Weight	Freight

8.6

W-375 1-14-54 1M

[illegible] Single ___ [illegible] ___ [illegible] ___ [illegible] ___
Double ___

[illegible] Surface ___

[illegible] Length ___

[illegible] Contact on Track ___

[illegible] Taken ___

[illegible] End Flg. ___ [illegible] Flg. ___

[illegible] Thickness ___

[illegible] Flange ___

9.1

May 20, 1954

CERTIFICATE OF INSPECTION AND TEST

This is to certify that the 2 - 20" Rensselaer List 13A, victaulic end gate valves covered by the W. M. Pattison Supply Company order B-8290, our SO 199 989 were subjected to and successfully withstood the required hydrostatic test pressure. These valves are built strictly in accordance with the City of Cleveland specifications.

RENSSELAER VALVE CO.

Frank VanDerwerken

Frank VanDerwerken
Chief Inspector

State of New York
County of Rensselaer
City of Troy

Subscribed and sworn to before me

this 20th day of May, 1954.

Paul F. Brown

Notary Public

B

…ndry …urns	Borings	BRIQUETS Si	Mn	Total Daily Cupola Metal Charged A to B incl.
,560		60	252	55,608
,490		58	242	53,292
,630		70	294	64,876
,360		72	304	67,192
,260		55	231	50,974
,270		62	262	57,924
,110		40	200	44,036
,700		-	315	69,435
,700		-	315	69,435
,180		-	231	50,919
,490		-	221	48,605
,040		-	168	37,032
,940		-	273	60,177
,490		-	221	48,605
,560		-	168	55,464
,560		-	168	55,464
,920		-	168	55,464
,730		-	154	50,842
,560		-	252	55,548
,650		-	231	50,919
,700		417	4670	1,101,811

RENSSELAER VALVE COMPANY

DIVISION OF THE NEPTUNE METER COMPANY

MONTHLY CHARGING RECORD

(REPORT ALL ITEMS IN POUNDS)

FOUNDRY NAME RENSSELAER VALVE CO. - IRON

Month April - 1954

A

	Date	Day	Heat No.	Coke	Flux	Treating Agent	Ferro Si	Ferro Mn	Ferro Cr	Ferro Mo	Cu Limestone	Ni	PIG IRONS Silvery	PIG IRONS Foundry	PIG IRONS Special	Rails or Springs	Auto Steel	Mang. Steel	Purchased Cast Iron	Mall. Scrap
	3/30	1	61	13500	216	96					1800			11,040			5520		22,080	
	3/31	2	62	13050	207	92					1725			10,580			6670		21,160	
	4/1	3	63	15300	252	112					2100			12,880			7130		25,760	
	4/2	4	64	15750	261	116					2175			13,340			7820		26,680	
		5																		
		6																		
	4/5	7	65	12600	198	88					1650			10,120			5980		20,240	
	4/6	8	66	13950	225	100					1875			11,500			7130		23,000	
	4/7	9	67	11250	171	96					1425			8,740			4370		17,480	
	4/8	10	68	16200	270	120					2250			13,800			6900		27,600	
	4/9	11	69	16200	270	120					2250			13,800			6900		27,600	
		12																		
		13																		
All Chgs. (	4/12	14	70	12600	198	88					1650			10,120			5060		20,240	
Est. Wt. (	4/13	15	71	12150	189	84					1575			9,660			4830		19,320	
No Scale (	4/14	16	72	8900	144	64					1200			7,360			3680		14,720	
(	4/15	17	73	14400	234	104					1950			11,960			5980		23,920	
(	4/16	18	74	12150	189	84					1575			9,660			4830		19,320	
		19																		
		20																		
	4/19	21	75	12600	216	96					1800			11,040			5520		22,080	
	4/20	22	76	13500	216	96					1800			11,040			5520		22,080	
	4/21	23	77	13500	216	96					1800			11,040			2760		22,080	
	4/22	24	78	12600	198	88					1650			10,120			5060		23,690	
	4/23	25	79	13500	216	96					1800			11,040			5520		22,080	
		26																		
		27																		
	4/26	28	80	12600	198	88					1650			10,120			5060		22,770	
		29																		
		30																		
		31																		
		TOTALS		266300	4284	1924					35700			215,960			112,240		443,900	

This report is lined for typewriter fill-in.

9.3

DAILY HEAT REPORT

Form M-547

Foundry.......... Metallurgist..........
Weather (Clear, Cloudy, Rain, Snow).......... Heat Date.......... Heat No..........
Purite or Flux on Bed..........lbs. Purite in Ladle..........lbs. Flux per Charge..........lbs. Lbs. Stone on Bed.......... In Charge..........
Coke Manufacturer.......... Coke Size..........x..........inches. Coke Bed, Height above Tuyeres..........inches
Coke Bed Weight..........lbs. Slag Color and Fluidity at Start.......... Mid-Heat.......... End..........
Tuyeres Dia..........in. MELTING ZONE: Av. Hgth. Max. Burnback..........in.; Av. Dia. Max. Burnback..........in. and Av. Max. Patch Dia..........in
Describe Condition (clean, dirty, rusty, burnt) and Size of Purchased Scrap in use: IRON SCRAP..........
..........; and STEEL SCRAP..........
Date New Coke Received.......... Manufacturer of New Coke.......... Size of New Coke..........x..........inches
Time Air On.......... Air Off.......... Average Melting Rate..........tons per hour

Starting	Blast (C.F.M.) Min.	Tap No.	Blast (C.F.M.)	Tap No.	Blast (C.F.M.)	Tap No.	Blast (C.F.M.)	Date Cupola Relined

Where Chemical Analysis Specimens are taken in Heat, indicate their location by inserting "TB" to the right of numerals in Tap No. Column; and where Physical Test Specimens are taken indicate by "PT" to the left of numerals. Also show "Shut Downs" by "SD" in Temperature Column.

Tap No.	Metal Spec. No.	Control'g. Metal Sect.	Max. & Min. Const'l Wedge Limits	Calcul. Optm. Wedge	Tap Time	Am't Tapped	Agent Ozs.	Actual Const'l Wedge	Actual Wedge	Pressure Ozs.	Coke Splits New	Coke Splits Used	Temp.	Calcul. % Alloy Added	Castings Names and Weights in Lbs.
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
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30															
31															
32															
33															
34															
35															
36															
37															
38															
39															
40															

Total Metal Charged for this Heat..........Lbs.

Metal Spec.	Returns	Foreign Scrap	Steel	Si Bqts.	Mn Bqts.		Pig (% Si= ; % Mn=)	Pig (% Si= ; % Mn=
					9.4			

Form No. M 530-R

DAILY SAND TEST REPORT

Date________________

Perm.	Green Comp.	Mois-ture	Dry Shear	Flow-ability	MATERIALS	Lbs.	SYSTEM SAND	Lbs.
					Silica Sand "B"		Fire Clay	
					Wood Flour		Pitch	
					Bentonite W_____ S_____		Sea Coal	
					SYSTEM FACING			
					Silica Sand "B"			
					Silica Sand 120-2			
					Wood Flour			
					Bentonite W_____ S_____			
					Fire Clay			
					Pitch			
					Sea Coal			
					FLOOR FACING			
					No. 4 Sand			
					Millville Gravel			
					Sea Coal			
					Pitch			
					Wood Flour			
					FLOOR SAND			
					Heap Sand			
					Millville Gravel			
					Pitch			
					Bentonite			
					BRASS FOUNDRY SAND			
					Floor No.			
					Floor No.			
					9.5			

System sand tests:

Perm.	Green Comp.	Moist-ture	Dry Shear	Flow-ability

Total Batches Mulled.............................

Form M-527 2000 10-53

No.________________

Testing Laboratory of The Rensselaer Valve Co., Troy, N. Y.

________________195____

TENSILE TEST REPORT

*For*________________ *Test Made by*________________

*Material*________________

Date	Mark	Original Diam.	Area	Elastic Limit		Ultimate Strength		Elongation		Reduced Diam.	Reduced Area	Re-duction %	REMARKS
				Load	Lbs. per sq. in.	Load	Lbs. per sq. in.	in ______in.	% in ______in.				

9.6

No. .... Testing Laboratory of The Rensselaer Valve Co., Troy, N. Y. 19

TRANSVERSE TEST REPORT

For .... *Test Made by* ....

Material ....

Date	Mark	Dimensions	Centers of Support	Deflection		Deflection		Deflection		Breaking Load	REMARKS
				Load	Reading	Load	Reading	Load	Reading		

9,7

RECEIVED AND REPORTED 2-8-54 DESCRIPTION	SIL.	MANG.	CARBONS			PHOS.	SUL.
			GRAPH.	TOTAL	COMB'D		
Heat #24 tap #1 2-4-54	1.95	.80	2.91		.54	.193	.112
Heat #24 tap #10 2-4-54	2.02	.80	2.87		.54	.199	.119

Rensselaer Valve Co.

Troy, New York

Attn: Mr. E. A. Castracani

Feb.-9 1954
REF.
ANS.

CHARLES C. KAWIN CO.

Per RL

CHICAGO-BUFFALO
Form 2 35M

Foundry [illegible]

Month of [illegible]

Date		Total Metal Charged Lbs.	Good Castings Lbs.	Pattern Shop	Slag and Inclusions	Cores Missing or Set Wrong	Swells	Drops	Sloppy Molding	Misc.	Returns from Machine Shop or Customer Lbs.
3/30	1	5?,608	43,9?					[illegible]		235	
3/31	2	55,292	44,4?					780			
4/1	3	6?,876	46,2?					2568			
4/2	4	67,192	42,0?					729			
	5										
	6										
4/5	7	50,?7?	41,43					755			
4/6	8	57,9?4	4?,5?		240			2123		54	
4/7	9	44,036	32,64					3047			
4/8	10	69,435	55,77					181			
4/9	11	69,435	54,41					530			
	12										
	13										
4/12	14	50,919	37,13		286			125			
4/13	15	48,605	37,21					[illegible]			
4/14	16	37,032	27,24		1454			345			
4/15	17	60,177	47,25					479		744	
4/16	18	48,605	36,60					110			
	19										
	20										
4/19	21	55,464	38,91					2184			
4/20	22	55,464	45,51		1310			221			
4/21	23	55,464	42,97					1146			
4/22	24	50,842	38,74					2?43			
4/23	25	55,548	37,56		789			3066			
	26										
	27										
4/26	28	50,919	38,54					1800			
	29										
	30										
	31										
Total Lbs.		1,101,811	829,309		4079			25123		1033	2?,[illegible]
End of Month Percentage		100%	%	%	5.5 %	%	%	34.0%	%	.4 %	[illegible]
Cumulative to Date Lbs.		4,417,975	3,377,69		13067	1239	350	49612	215	7016	75,[illegible]
Cumulative to Date %					4.9	.5	.1	37.4	.1	2.6	[illegible]

9.9

9.10

RENSSELAER VALVE COMPANY

EXPENSE CODING SHEET

JE. NO. ________

MO. & YR. ________

REG #	PO #	EXP ACCOUNT DESCRIPTION	DEPT.	EXP	AMOUNT	TOTAL	VO #	CK

11.1

RENSSELAER VALVE COMPANY
BASIS FOR DISTRIBUTION OF SERVICE DEPARTMENTS

Department

459 Yard (Casting Storage)

Function: To provide for the orderly storage of rough castings preliminary to the machining operations.

Distribtuion: This department is operated to facilitate the supply of castings to the Machine Shop operations. It is based upon an estimated service rendered basis to

455 - Machine Shop - Large Valves	20%
456 - Machine Shop - Small Valves	40%
458 - Machine Shop Hydrants	40%

460 Tool Crib

Function: To provide for an orderly storage and minor repairs to perishable and small tools and equipment.

Distribution: This department serves the Machine Shop departments primarily and is distributed

455 - Machine Shop - Large Valves	45%
456 - Machine Shop - Small Valves	32%
457 - Machine Shop - Upstairs	18%
458 - Machine Shop - Hydrants	5%

461 Pattern Shop

Function: Preparation and maintenance of pattern equipment for Iron and Brass Foundry

Distribution: This department expense is distributed on the basis of an estimated time distribution made up by the Pattern Shop Foreman and Foundry Superintendent.

451 Iron Foundry - Units	35%
452 Iron Foundry - Floor	50%
453 Brass Foundry	15%

Department -

Department	Description
463 Core Room	Function: Preparation of Cores for both Iron and Brass Foundry molds. Distribution: Based on the average % of Core Room hours employed in producing cores for the molding departments. This distribution of Core Room hours was prepared with the Foundry Superintendent.
481 Plant & Office (Grounds & Buildings)	Function: A departmental designation to provide for the accumulation of expense applicable to general plant and property not allocable directly on a departmental basis. Distribution: Based upon the square foot occupancy of the tenantable manufacturing area. 451 - Iron Foundry - Mach. Units 30% 452 - Iron Foundry - Floor 18% 462 - Melting 4% 453 - Brass Foundry 4% 454 - Chip & Clean 5% 455 - Mach. Shop - Large Valves 15% 456 - Mach. Shop - Small Valves 9% 457 - Mach. Shop - Upstairs 10% 458 - Mach. Shop - Hydrants 5%
541 Inspection	Function: Examine on a random basis castings, finished valves and hydrants in the process of manufacturing to ascertain the quality of the material and workmanship. Distribution: This basis was established using an estimated time distribution by the Inspection foreman. 451 - Iron Foundry - Units 36% 452 - Iron Foundry - Floor 10% 453 - Brass Foundry 4% 455 - Mach. Shop - Large Valves 23% 456 - Mach. Shop - Small Valves 16% 457 - Mach. Shop - Upstairs 8% 458 - Mach. Shop - Hydrants 3%

Department -

542 Product Engineering

Function: To prepare Bills of Material, parts lists, parts and assembly drawings and other engineering data.

Distribution: This department's expense is distributed on the basis of the actual job time spent as recorded on the daily Time Distribution card. The job times are classified into the following groups.

(a) Manufacturing
(b) Product Development
(c) Customer Service
(d) Other

(a) The portion allocable to Manufacturing is distributed between the Foundry and Machine Shop on a 50/50 basis and then to the individual manufacturing departments on a direct labor basis.

(b) The portion applicable to Product Development is charged to the cost of sales for the current period.

(c) The portion applicable to Customer Service is included as a charge to current revenue under the heading of Selling Expense and Customer Service.

(d) The portion accumulated under "Other" is allocated according to the nature of the job.

543 Industrial Engineering

Function: Conducts time studies, job analysis, workplace layout reviews, method studies, prepares work measurement standards and special studies as required.

Distribution: To the manufacturing departments benefitting as determined by the Time Distribution card allocation of hours.

Department -

545 Maintenance Shop

Function: To maintain in usable condition the buildings, machinery, equipment and work areas necessary to the Company's operations.

Distribution: This distribution is based on an estimated time distribution developed with the Maintenance Foreman. The primary split allocates 56% of the cost to Foundry and 44% to the Machine Shop. Then the following apportionment is made of these amounts.

451 - Iron Foundry - Units	73%
452 - Iron Foundry - Floor	20%
453 - Brass Foundry	7%
455 - Mach. Shop - Large Valves	45%
456 - Mach. Shop - Small Valves	32%
457 - Mach. Shop - Upstairs	18%
458 - Mach. Shop - Hydrants	5%

547 Boiler Room - Watchman

Function: The Boiler Room includes the employees and facilities for providing heat, compressed air, etc. As a related job the Boiler Room employees serving as Watchmen make periodic trips through the plant to detect any conditions that might result in loss or damage due to fire, water damage, theft or vandalism.

Distribution: Distributed on a 50/50 basis between Foundry and Machine Shop areas taking into consideration floor space area occupied and heating requirements.

451 - Iron Foundry - Units	19%
452 - Iron Foundry - Floor	57%
462 - Melting	11%
453 - Brass Foundry	6%
454 - Chip & Clean	7%
455 - Mach. Shop - Large Valves	35%
456 - Mach. Shop - Small Valves	30%
457 - Mach. Shop - Upstairs	20%
458 - Mach. Shop - Hydrants	15%

Department -

551 Planning & Scheduling

Function: Planning and Scheduling of manufacturing orders together with the control of materials in inventory.

Distribution: This function is distributed on an estimated basis of 30% to Foundry and 70% to the Machine Shop, taking into account the direct assignment of a planning clerk to the Foundry.

451 - Iron Foundry - Units	73%
452 - Iron Foundry - Floor	20%
453 - Brass Foundry	7%

455 - Mach. Shop - Large Valves	45%
456 - Mach. Shop - Small Valves	32%
457 - Mach. Shop - Upstairs	18%
458 - Mach. Shop - Hydrants	5%

553-554 Finished Parts Stockroom

Function: To store in an orderly manner and maintain a record of all finished parts which do not move directly from the machining to the assembly operations.

Distribution: This function is maintained to facilitate the machining and assembly operations and is distributed to these departments on an estimated service basis developed with the Machine Shop Supt.

455 - Mach. Shop - Large Valves	45%
456 - Mach. Shop - Small Valves	32%
457 - Mach. Shop - Upstairs	18%
458 - Mach. Shop - Hydrants	5%

548 Supervisory Training

Function: This is a departmental designation for the accumulation of expense incurred in supervisory training such as film rental, textbooks, periodicals or other training materials or instructions.

Distribution: To all manufacturing areas based on the numbers of employees from each department participating in the program.

Department -

549 Research

Function: This function could be more accurately defined as Product Improvement and represents minor expenditures which are apportioned to the manufacturing department affected by the project. It is recognized that Research is not properly manufacturing expense; however, the minor amounts involved and the borderline nature of the function does not warrant other treatment.

581 Purchasing
582 Receiving & Shipping

Function: Purchasing - To secure the necessary materials, supplies, equipment and Purchased services at the best prices consistent with quality and delivery requirements and also to handle the details of routing and traffic.

Receiving - To provide for the physical receipt of incoming materials, to prepare a record of the receipt, to verify the quantity, condition and to the extent possible the apparent quality of the material. Following the receipt and examination to dispatch the materials to the proper storage of use location.

Shipping - To handle outgoing shipments, including the preparation of the necessary shipping papers, bills of lading, insurance, certificates, etc. It is recognized that this function is properly a distribution, not a manufacturing cost but since the work force is common between receiving and shipping segregation of the two is not practical.

Distribution: These functions are distributed on an estimated service basis of 20% to Foundry and 80% to the Machine Shop. It takes into account the fact that Foundry department labor unloads the Foundry raw materials and the cost is borne directly by the Foundry. It also is recognized that the Purchasing effort required to supply these materials is not as great as is required for the variety of purchased parts and services necessary to the Machine Shop operations.

Department -

Department	
581 Purchasing (Contd.) 582 Receiving & Shipping	The distribution follows: 451 - Iron Foundry - Units 73% 452 - Iron Foundry - Floor 20% 453 - Brass Foundry 7% 455 - Mach. Shop - Large Valves 45% 456 - Mach. Shop - Small Valves 32% 457 - Mach. Shop - Upstairs 18% 458 - Mach. Shop - Hydrants 5%
591 Cost Accounting Time Keeping Payroll	Function: To keep a record of employees' time, to calculate and make up the payroll, to develop product and departmental cost and such operating reports as may be required. Distribution: To all manufacturing departments on the basis of the direct labor dollar.
593 Office Service Mail Service Telephone	Function: This department includes the telephone service, the administration of life and disability insurance plans and mail service. Distribution: To all manufacturing departments on the direct labor dollar basis.

FORM ADC

RENSSELAER VALVE COMPANY
ANALYSIS OF DEPARTMENTAL COSTS

DEPT.

ACCT. NO.	EXPENSE CLASSIFICATION	Current Month	Previous Month	1954	Year to Date
101	Direct Labor				
102	Indirect Labor				
105	Maintenance & Repair Labor				
110	Clerical Salaries & Wages				
111	Tech. & Spec. Salaries & Wages				
112	Supervisory Salaries & Wages				
113	Executive Salaries & Wages				
130	Operating Supplies				
131	Maint. & Repair Serv. & Supplies				
132	Alterations & Repairs (Patterns) Purch.				
133	Perishable Tools				
134	Hand Tools & Small Equipment				
135	Fuel, Coke, Gas, Oil, Etc.				
136	Energies, Electricity, Etc.				
137	Telephone & Telegraph				
138	Postage, Stat. & Printed Forms				
139	Office Supplies, Other				
140	Pensions				
142	Insurance on Payroll				
143	Insurance on Property				
144	Ins. Group Life & Weekly Indemnity				
145	Taxes, Real Estate				
146	Taxes, Other				
147	Depreciation				
148	Warehouse Service				
149	Taxes on Payroll				
151	Travel & Transportation				
152	Hotel & Meals				
153	Entertainment				
154	Travel, Other				
156	Catalogues & Brochures				
157	Convention Expense				
162	Dues & Subscriptions				
163	Professional Fees				
170	Scrap-Losses-Spoilage				
171	Demurrage				
172	Material for Research or Test Purposes				
	Total Expense				
	Core Expense				
	Share of Other Apportioned Exp.				
	Total Apportioned Expense				
	Total Dir. and Apportioned Exp.				
	Overhead per Direct Labor Dollar				
	Melt				
	Total Good Production				
	Total Chipped & Clean (Iron)				
	Total Chipped & Clean (Brass)				
	Total Iron & Brass Chipped & Cleaned				

Rensselaer Valve Company
IRON FOUNDRY
DAILY RAW MATERIALS REPORT

DATE HEAT No.

MATERIALS USED		TOTAL PER CHARGE	TOTAL FOR DAY	TOTAL MONTH TO DATE
Coke				
Limestone				
Flux				
Silico Manganese Briquets				
Ferro Manganese Briquets				
Ferro Manganese Ground				
Ferro Silicon Briquets				
Ferro Silicon Ground				
Dope C-2 Alloy				
Pig Iron—Malleable	%			
Pig Iron—Silvery				
Cast Scrap				
Own Returns				
Steel Scrap				
TOTAL METAL CHARGED				

MATERIAL	TOTAL TO DAY	%	OWN RETURNS TO DAY	OWN RETURNS MONTH TO DATE	Total Good Castings and Scrap Castings MONTH TO DATE	DAILY
Cupola Drop			X X X	X X X	X X X	Charges:
Pig Bed					X X X	Taps:
Gates & Risers					X X X	Month to Date
Good Castings			X X X	X X X		Yield % ______
Scrap Castings						Scrap % ______
Melting Loss			X X X	X X X	X X X	
TOTAL		100				

11.5

Signed________________________ Foundry Clerk

Form M-524-R 1M 1-54

FOUNDRY PRODUCTION SCHEDULE

_______________ 19____

SIZE	LIST	DESCRIPTION	STD. HRS.	ACT. HRS.	MLD. STD.	MLD. ACT.	% OF PERF.

M-548 5M-11-53-RP

11.6

RENSSELAER VALVE COMPANY

No. 17400

FOUNDRY DELIVERY TICKET

ORDER NO. ____________________ DATE ____________________ 19____

DELIVER TO				MATERIAL						
YARD	☐	SCRAP	☐	IRON	☐	60M BRASS	☐	UNITS	1, 1A, 2, 3	☐
BASEMENT	☐		☐		☐	80M BRASS	☐		4, 4A, 9	☐
	☐				☐	85-5-5-5	☐		5, 7, 8	☐

PCS.	SIZE	LIST	DESCRIPTION	UNIT WT.	TOTAL WT.

UARCO INC., DEEP RIVER, CONN.

SOLD TO	NO. REQ'D.	S.O. RE-ISSUED DATE 8-25-52	NO BM 14304-1 87 New Formerly BM 87
SHIP TO		BM BK. PG.	SHEET 1 OF 1 / ASSEMBLY DWG. NO. POS 573-5-57 FM 13300-18
	SCHEDULE		OPEN LT. RT.

14" List 13A-N.R.S. Flg. End Valve with Handwheel

VERT. IN HORIZ. PIPE	X
HORIZ. IN HORIZ. PIPE	
FLAT IN VERT. PIPE	

BILL OF MATERIAL

PART NAME	CAST	MACH.	WEIGHT	REQ. ONE UNIT	CASTING NO.	PART NO.	MAT'L	DRAWING NO.	
Case Flg.				1	14-304	14-304	C.I.	C-8399	
Cover -N.R.S.				1	14-316	14-316	"	C-8346	
Gate-Long				1	14-1327	14-1327	"	C-8388	
Gate-Short				1	14-1325	14-1325	"	"	
Hooks				2	M-9	M-9	"	"	
Stuffingbox				1	S-8B	S-8B	"	A-7500	
Follower Plate				1	FP-95A	FP-95A	"	B-7560	
Handwheel				1	H-22	H-22T	"	A-6656	
Wedges				2	W-41	W-41	R-42	C-8390	
Gate Rings				2	UR-17	UR-17	"	"	
Seat Rings				2	R-33A	R-33A	"	"	
Follower GLAND				1	FG-50	FG-50	"	A-7501	
Stem				1	J-15H	J-15U	R-54	A-6721E	
Stem Nut				1	K-31	K-31	"	A-6728B	
Straps				2	0-3	0-3	R-42	A-6660	
Pegs Sq.Hd.1-1/8"Lg.				4	1/2"-13N.C.	P-3	Sil.Brz.	"	5/8"-Thd.
All Bolts Regular, All Nuts Heavy					Rust Proof Bolts and Nuts				
Cover Flange Bolts				18	3/4-10UNC-2Ax3-1/2"		Stl.	Sq.Hd.&H.N.	1-3/4" Thd.
St-Box & Foll. Bolts				2	7/8"-9UNC-2Ax7"		"	Tee Hd.	5-1/2" Thd.
Stuffing box bolts				2	7/8"-9UNC-2Ax3"		"	Tee Hd.	1-3/4" Thd.
Stuffingbox Nuts				4	7/8"-9UNC-2B		"	Hex.	
Follower Nuts				2	7/8"-9UNC-2B		Brass	Hex.	
Test Plug				1		1/2"	C.I.		
Stem Key				1	1/2x1/2x3		Stl		
Cover Flange Gasket				2		14-315	J.M. Seig.#711	PB-8350	
Stuffingbox Gasket				2		SG-8B	J.M. Seig.#711	PA-8349	
Stem Tap Bolt				1	3/4"-10UNC-2Ax1-1/2"		Stl.	Hex Hd.T.B.	1-1/8"Thd.
Packing				1	5/8" Sq.x40" Flax Garlock #31				
Handwheel WASHER				1	3/4" Std.		Stl.		

DATE STARTED ______________

DATE COMPLETED ______________

DATE SHIPPED ______________

JOB NO. ______________

SO. NO. ______________

PURCH. COST		UNIT WGHT	TOTAL WGHT		FOUNDRY HOURS						MACHINE SHOP HOURS					
Unit	Total	WGHT	Iron	Brass	Unit Hrs.	Dept.	451	452	453	463	Unit Hrs.	Dept	455	456	457	458

RENSSELAER VALVE COMPANY

COST SUMMARY

____

____

____.____	Lbs. (Brass) X Cost Lb. at Spout	$____.____	$____.____
____.____	Lbs. (Iron) X Cost Lb. at Spout	____.____	____.____
____.____	Hrs. D/L (451) X Composite Rate	____.____	____.____
	Add Scrap & Spoilage	____.____%	____.____
____.____	Hrs. D/L (452) X Composite Rate	$____.____	____.____
	Add Scrap & Spoilage	____.____%	____.____
____.____	Hrs. D/L (453) X Composite Rate	$____.____	____.____
	Add Scrap & Spoilage	____.____%	____.____
____.____	Hrs. D/L (463) X Composite Rate	$____.____	____.____
	Add Scrap & Spoilage	____.____%	____.____
____.____	Lbs. (Total) X C&C Cost per Lb.	$____.____	____.____
	Total Foundry Cost		$____.____

____.____	Hrs. D/L (455) X Composite Rate	$____.____	$____.____	
____.____	Hrs. D/L (456) X Composite Rate	____.____	____.____	
____.____	Hrs. D/L (457) X Composite Rate	____.____	____.____	
____.____	Hrs. D/L (458) X Composite Rate	____.____	____.____	
	Total, Labor & O'head, M/Shops			$____.____
	Add Allowance for Scrap & Other	____.____%		____.____

Total Machine Shop Cost		$____.____
Purchased Parts & Castings		$____.____
Total Manufacturing Cost		$____.____
Selling & Gen. Admin. Exp.	____.____% (Mfg. Cost)	$____.____
Total Cost F. O. B. Troy		$____.____
Add Freight	( ) Est. ( ) Act.	$____.____
Add Profit	____.____% (Mfg. Cost)	$____.____
SELLING PRICE		$____.____

______________________________ Date Costed ____________

By ____________

______________________________ Rates as Computed for the Month of ____________

Form______ 11-53

COMPOSITE RATE - FOUNDRY

		451	452	453	46
(1)	Monthly Analysis of Dept. Costs	$	$	$	$
	Adjustment for Core Apportionment				
(2)	Less: Core Apportionment	$	$	$	
(3)	Add: Core Apportionment (Total)				$
(4)	Monthly Dept. Expense as Adjusted for Core Apportionment	$	$	$	$
	Adj. for Direct Labor Hour Distrib:				
(6)	Ratio, Dept to Total Shop				
(7)	Departmental DirLab Cost	$	$	$	$
(8)	(6) X Total Shop DirLab Cost	$	$	$	$
(9)	Variance	$	$	$	$
	Adj. for Indirect LabHr Distrib:				
(10)	Ratio, Dept to Tot. Shop				
(11)	Dept. Indirect Labor Cost	$	$	$	$
(12)	(10) X Total Shop IndrLab Cost	$	$	$	$
(13)	Variance	$	$	$	$
(14)	(9) + (13) Total Variance	$	$	$	$
(15)	(14) plus or minus (4) Departmental Expense as Adjusted	$	$	$	$
(16)	(15) ÷ Direct Labor Hours Composite Rate Per Hour	$	$	$	$

11.10

COMPOSITE RATE - MACHINE SHOPS

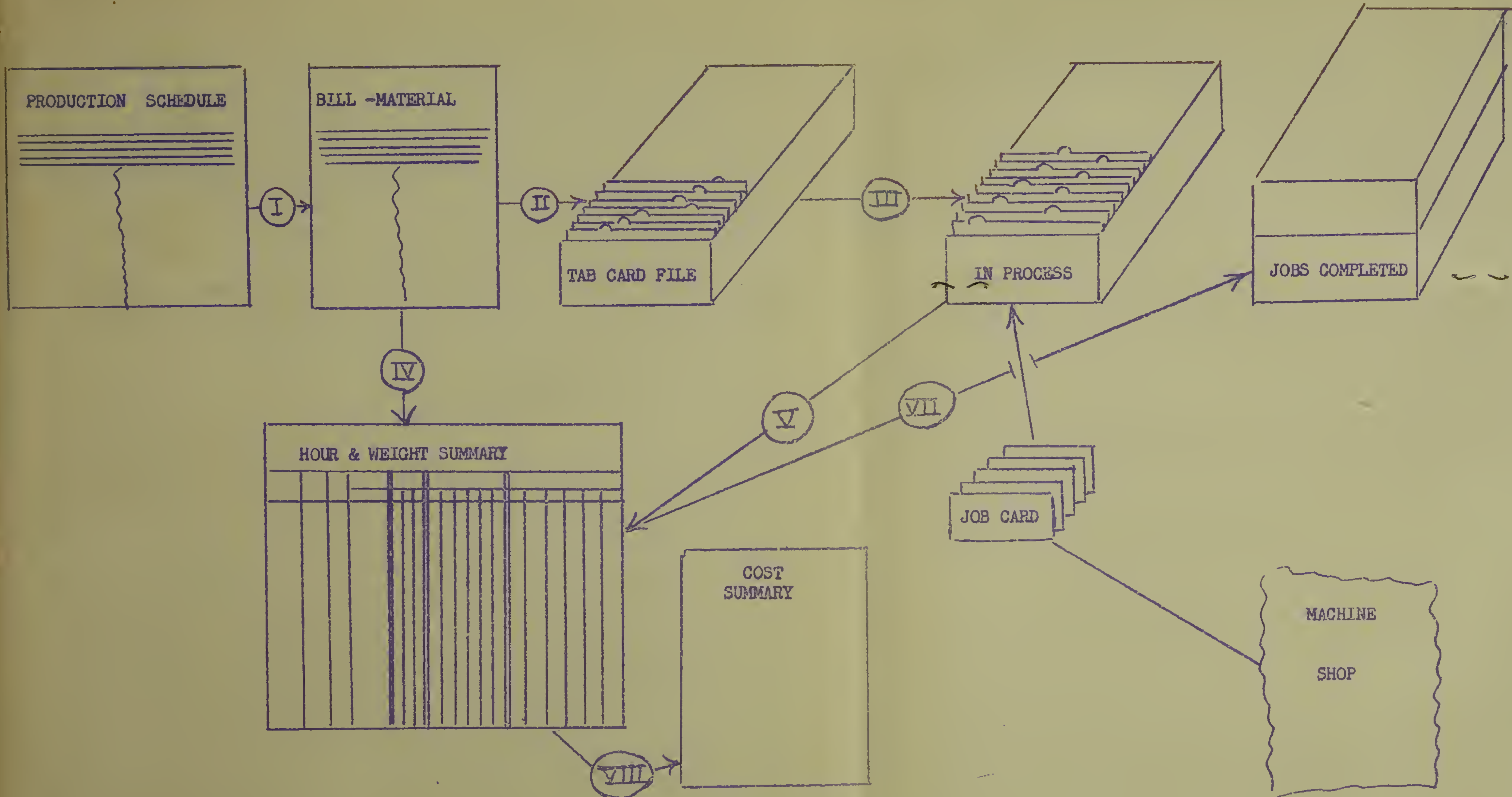
		455	456	457	458
(1)	Monthly Analysis of Dept. Costs	$	$	$	$
	Adjustment for Main. Labor:				
(2)	Less: Main Labor (457-#105)	$	$	$	$
(3)	Apportionment of MainLabor (¼)	$	$	$	$
(4)	Monthly Dept. Expense As Adjusted for Maintenance Labor	$	$	$	$
	Adj. for Direct Labor Hour Distrib:				
(6)	Ratio, Dept to Tot Shop				
(7)	Departmental DirLab Cost	$	$	$	$
(8)	(6) X Total Shop DirLab Cost	$	$	$	$
	Variance	$	$	$	$
	Adj. for Indirect LabHr Distrib:				
(10)	Ratio, Dept to Tot. Shop				
(11)	Dept. Indirect Labor Cost	$	$	$	$
(12)	(10) X Total Shop IndrLab Cost	$	$	$	$
(13)	Variance	$	$	$	$
(14)	(9) + (13) Total Variance	$	$	$	$
(15)	(14) plus or minus (4) Departmental Expense as Adjusted	$	$	$	$
(16)	(15) ÷ Direct Labor Hours Composite Rate Per Hour	$	$	$	$

11.11

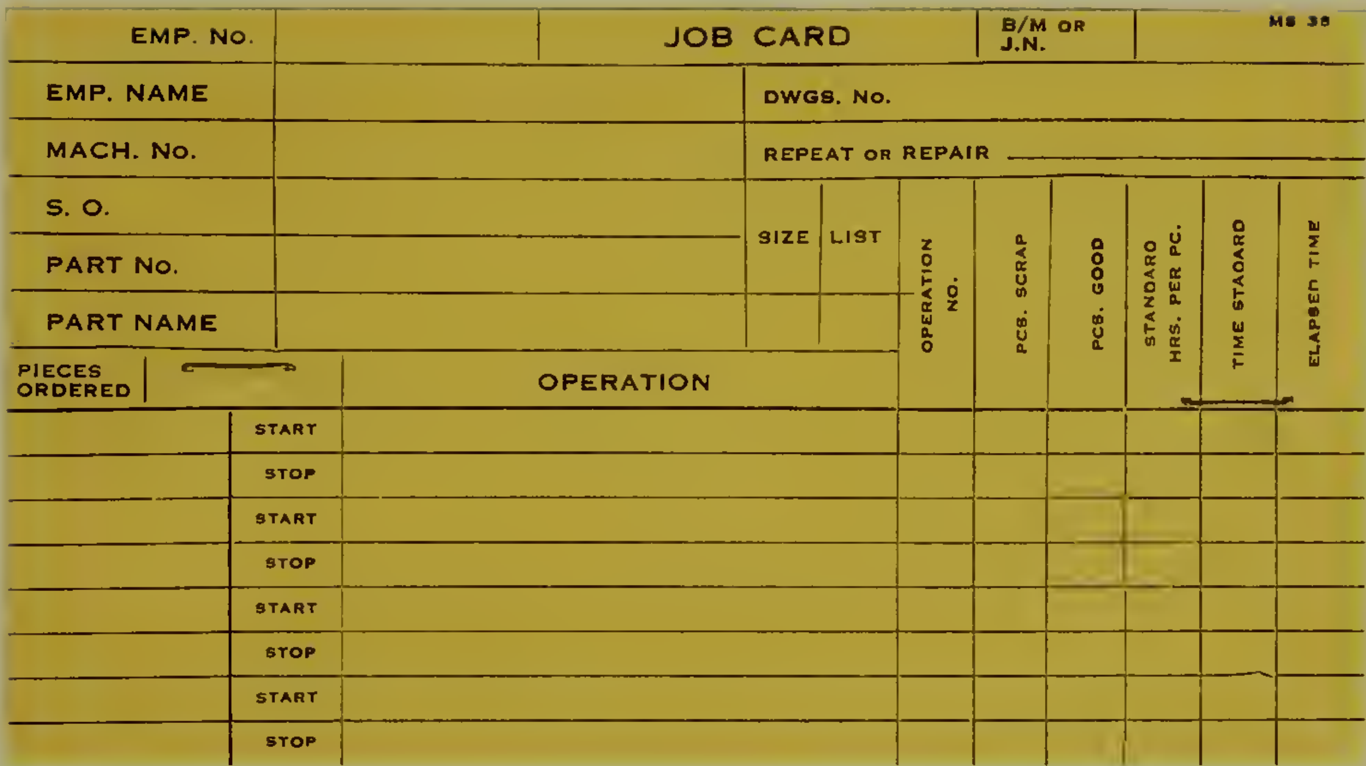
DEPARTMENT AND [illegible] COSTS
COST FOR MONTH OF ________
FACTORED TO ________

[illegible]	BASE COST	EFF.	FACTORED COST	MAT'L COST	OTHER COST	[illegible] %	OTHER %
51							
52							
53							
[illegible]							
55							
56							
57							
58							
[illegible]ASS							
[illegible]							
[illegible] AND CLEAN							
[illegible]							
[illegible]							

11.12



JOB COST - FILING AND COMPUTING PROCEDURE



EMP. No.
JOB CARD
B/M OR J.N.
MS 38
EMP. NAME
DWGS. No.
MACH. No.
REPEAT OR REPAIR
S. O.
PART No.
PART NAME
SIZE
LIST
OPERATION NO.
PCS. SCRAP
PCS. GOOD
STANDARD HRS. PER PC.
TIME STANDARD
ELAPSED TIME
PIECES ORDERED
OPERATION
START
STOP
START
STOP
START
STOP
START
STOP

11.13

11.14

ANALYSIS FOUNDRY SCRAP REPORTED
IRON AND BRASS
FEBRUARY 1954

Line Iron

Total Scrap Reported 61,430#

61,430# x 85% -	52,216	Before Chip & Clean
61,430# x 15% -	9,214	During Chip & Clean Operations
TOTAL	61,430	

52,216 x .0640 -	$3,341.82
9,214 x .0740 -	681.84
61,430# TOTAL	$4,023.66

Floor Iron

Total Scrap Reported 7,564#

7,564# x .1917 - $1,450.02

Brass

Total Scrap Reported 6,465#

6,465# x .4017 - $2,596.99

TOTAL COST LINE SCRAP PRODUCED		$4,023.66
TOTAL COST FLOOR SCRAP PRODUCED		1,450.02
TOTAL COST LINE & FLOOR SCRAP PROD.		$5,473.68
Less Allowance For Scrap		
68,994 x 16.9642 M -		1,170.43
NET SCRAP LOSS		$4,303.25
TOTAL COST SCRAP PRODUCED (BRASS)		$2,596.99
Less Allowance for Scrap		
85-5-5-5 - 3,441# x .23 -	$791.43	
Mang. 60,000 - 3,024# x .245-	740.88	1,532.31
NET SCRAP LOSS		$1,064.68
RECAP: TOTAL NET SCRAP LOSS IRON		$4,303.25
TOTAL NET SCRAP LOSS BRASS		1,064.68
TOTAL NET SCRAP LOSS IRON & BRASS		$5,367.93

11.16

[illegible]
MACHINE SHOP SCRAP
APRIL, 1954

DEPT.	M.S. HOURS CHARGEABLE TO M.S.	M. SHOP VALUE	FOUNDRY VALUE CHARGEABLE TO M.S.	TOTAL VALUE
455	--	--	$ 10.03	$ 10.03
456	20.749	66.19	166.23	232.42
457	--	--	--	--
458	2.000	7.06	19.16	26.22
Total	22.749	$73.25	$195.42	$268.67

DEPT.	M.S. Hours CHARGEABLE TO FDY.	M. SHOP VALUE	FOUNDRY VALUE CHARGEABLE TO FDY.	TOTAL VALUE
455	50.000	234.50	1,097.03	1,331.53
456	60.917	194.29	1,452.48	1,646.77
457	5.917	21.30	17.76	39.06
458	33.000	116.49	343.85	460.34
Total	149.834	$566.58	$2,911.12	$3,477.70

MISCELLANEOUS COST DUE TO VENDOR'S CASTINGS ETC.

DEPT.	M.S. HOURS			
455	6.000	28.14	--	28.14
456				
457				
458	8.000	28.24	--	28.24
Total	14.000	$56.38	--	$56.38
GRAND TOTAL	186.583	696.21	3,106.54	$3,802.75
LESS SCRAP VALUE				691.62
NET SCRAP LOSS M.S.				$3,111.13

ADD:

NET SCRAP LOSS PRODUCED IN FOUNDRY

62,537#	- Line -	$3,651.21	
11,463#	- Floor -	2,015.61	
3,194#	- Brass -	484.77	6,041.59

TOTAL NET SCRAP LOSS - IRON & BRASS - $9,152.72

ANALYSIS FOUNDRY PRODUCTION
UNITS 5-7-8
WEEK ENDING 5/2/54

DATE	SIZE	LIST	DESCRIPTION	PCS. PROD.	UNIT WGT.	TOTAL WGT.
4/26/54	16	14-A	Sq.Bo. Cover OS&Y	1	485	485
	16x6		Front (STARTED)	1		
			DP-128	2	100	200
			Flask Bar 76"L	2	100	200
	20	13-A	Flg. Case	1	1150	1150
	18		Wheel	1	42	42
	16	14	Sq.Bo. Flg. Case 4" B/P SG	1	1525	1525
	24	13-A	Hub Case 4" B/P SG	1	1631	1631
			Flask Bar 76"L	1	100	100
	20x6		Cross Back	1	343	343
	8		Cyl. 19"L	1	178	178
	24	13	Vict.Case 4" B/P BG CWD	1	1935	1935
	8		Cyl. 19"L	1	178	178
				TOTAL		7967
4/27/54	16	14	Sq.Bo. Cover OS&Y	1	485	485
	8	13-A	Sq.Bo. Flg. Case 250#	1	335	335
	16x6		Front	1	286	286
			DP-128-1	2	100	200
			76" Flask Bar	2	100	200
	8		Cyl. 19"L	3	178	534
	7		Cyl. 10-3/4"L	1	108	108
	14x16	340	Flg. Ck. Case	1	580	580
	20	13-A	Flg. Case	1	1150	1150
	16	14-A	Sq.Bo. Flg. Case 4" B/P SG	1	1525	1525
	16x6		Front	1	286	286
	8	13-A	Sq.Bo. Cover W/Shelf	1	95	95
	24	13-A	Hub Case 4" B/P SG	1	1631	1631
	16x12		Front	1	374	374
				TOTAL		7789
4/28/54	14	13-A	Sq.Bo. Cover W/Shelf	1	220	220
	16x8		Front	1	318	318
			DP-128	2	100	200
	12	13-A	Sq.Bo. Flg. Case	1	490	490
	14x16	340	Flg. Ck. Case	1	580	580
	20	13-A	Flg. Case	1	1150	1150
			76" Flask Bar	1	100	100
	16	14-A	Sq.Bo. Flg. Case 4" B/P SG	1	1525	1525
			76" Flask Bar	1	100	100
	16	13	Mech. Jt. Case	1	665	665
	16x12		Back	1	350	350
			76" Flask Bar	1	100	100
	24	13-A	Hub Case 4" B/P SG	1	1631	1631
			76" Flask Bar	1	100	100
				TOTAL		7529

ANALYSIS FOUNDRY PRODUCTION
UNITS 5-7-8
WEEK ENDING 5/2/54

DATE	SIZE	LIST	DESCRIPTION	PCS. PROD.	UNIT WGT.	TOTAL WGT.
4/29/54			DP1-13-14	1	270	270
	8		Rep. Sleeve Back 30"L	1	176	176
	20	12	Cover NRS	1	230	230
			CC-40 Cyl. Cover	2	125	250
			76" Flask Bar	1	100	100
	20	13-A	Flg. Case	1	1150	1150
	7		Cyl. 10-3/4"L	1	108	108
	16	14-A	Sq.Bo. Flg. Case 4" B/P SG	1	1525	1525
	20	13-A	Cover NRS 4 Bolt	2	440	880
	20x6		Front	1	343	343
	24	13-A	Hub Case	1	1436	1436
	14	13-A	Sq.Bo. Cover W/Shelf	1	220	220
	16x6		Cross Back	1	272	272
				TOTAL		6960
4/30/54	16x8		Front	1	318	318
	14	13-A	Sq.Bo. Cover W/Shelf	1	220	220
	4	14	Flg. Case	1	100	100
	24x4		Front	1	400	400
	24	13	Vict. Case 4" B/P BG	1	1935	1935
	16	13	Mech. Jt. Case	1	665	665
	20	13-A	Flg. Case	1	1150	1150
	20x6		Front	1	343	343
	16-20		Wall Brkt.	1	68	68
	16	14-A	Sq.Bo. Flg. Case 4" B/P SG	1	1525	1525
	7		Cyl. 15"L	2	130	260
	8	13-A	Sq.Bo. Cover OS&Y	1	88	88
	12		Cyl. 9"L	1	130	130
			DP-128	2	100	200
				TOTAL		7402

GRAND TOTAL GROSS PRODUCTION - 37,647

ANALYSIS FOUNDRY SCRAP REPORTED
UNITS 5-7-8
WEEK ENDING 5/2/54

DATE	TICKET NO.	SIZE	LIST	DESCRIPTION	PCS. SCRAP.	UNIT WGT.	TOTAL WGT.
4/26/54	16957	7		Cylinder 10-3/4" F to F	1	108	108
		14	13-A	NRS Covers	1	440	440
				Total Scrap Reported -			548
4/27/54	16989			No Scrap Reported.			
4/28/54	17024			No Scrap Reported.			
4/29/54	17065			No Scrap Reported.			
4/30/54	17097			No Scrap Reported.			
				GRAND TOTAL SCRAP REPORTED			548

GRAND TOTAL GROSS PRODUCTION	37,647	100.0%
GRAND TOTAL SCRAP REPORTED	548	1.46%
	37,099	98.54%

BRASS PRODUCTION
WEEK ENDING 5/2/54

BRASS

TOTAL PRODUCTION	17,831	100.0%
TOTAL SCRAP REPORTED	773	4.34%
TOTAL NET GOOD	17,058	95.66%

IRON PRODUCTION LINE
WEEK ENDING 5/2/54

IRON UNITS 1-1A-2-3

TOTAL PRODUCTION	180,313	100.0%
TOTAL SCRAP REPORTED	16,032	8.89%
TOTAL NET GOOD	164,281	91.11%

UNITS 4-4A

TOTAL PRODUCTION	6,602	100.0%
TOTAL SCRAP REPORTED	1,627	24.64%
TOTAL NET GOOD	4,975	75.36%

UNIT NO. 9

TOTAL PRODUCTION	2,428	100.0%
TOTAL SCRAP REPORTED	None	None
TOTAL NET GOOD	2,428	100.0%

- -

GRAND TOTAL GROSS PRODUCTION	189,343	100.0%
GRAND TOTAL SCRAP REPORTED	17,659	9.33%
GRAND TOTAL NET GOOD	171,684	90.67%

MONTHLY ANALYSIS
IRON & BRASS CHIPPED AND CLEANED
20 WORKING DAYS
JANUARY 29, 1954

Date Wk. Ending	Total Chipped & Cleaned	Chipped & Cleaned Line 1-1A-2-3	Chipped & Cleaned Units 4-4A	Chipped & Cleaned Units No. 9	Chipped & Cleaned [illegible]
1/10/54	211,942	179,340	6,049	2,009	24,5[illegible]
1/17/54	204,352	173,416	4,568	880	25,[illegible]
1/24/54	220,116	184,798	2,626	978	31,[illegible]
1/31/54	219,351	180,581	6,128	396	[illegible]
TOTAL IRON	855,761	718,135	19,371	4,263	113,[illegible]

BRASS

REG. METAL	20,576
MANG. METAL	55,576
TOTAL BRASS	76,152
TOTAL IRON & BRASS	931,913

...ING	PIG IRON		CAST SCRAP		STEEL SCRAP		OWN RETURNS		COKE		OTHER						
	QUAN.	VALUE	QUAN.	VALUE	QUAN	VALUE	QUAN.	VALUE	QUAN.	VALUE	QUAN.	VALUE	TOTAL CHGS.	METAL COST PER POUND	LABOR COST PER POUND	O.H. COST PER POUND	COST PER POUND AT SPOUT

11.20

SUMMARY OF OPERATIONS

WEEK ENDED ________________

PAYROLL:

DEPARTMENT	No. of Men	HOURS		EARNINGS		
		WORKED	O. T. EQUIV.	REGULAR TIME	O. T. BONUS	TOTAL
Machine Shop						
Pattern Shop						
Iron Foundry: Molders						
Laborers						
Brass Foundry: Molders						
Laborers						
Total Plant						
Office						
Total Payroll						

Average Plant Rate Per Hour ____________

PRODUCTION:

DEPARTMENT	UNIT OF MEASURE			Days Worked	UNIT	TOTAL	Avg. Rate per Hr.
Machine Shop	Value of V's and H's assembled (July 1945) (Zone 1 Prices)				$		Prod. per M/H
Iron	Total Melt				Lbs.		Avg. Rate per Hr.
Foundry	Total Scrap (%)	Avg. Daily Tonnage		Number of Heats	"		Labor Cost per lb.
	Total Good Castings (% Yield)				"		Lbs. per M/H

DEPARTMENT		Av. Wt. Per Heat	Total Metal Melted		Lbs.	% Recovery	Good Castings	X X X
Brass	Regular Metal Castings				"			Avg. Daily Lbs.
Foundry	Manganese Bronze Castings				"			Avg. Rate per Hr.
	Other Metal Castings				"			Labor Cost per lb.
	Total Good Castings							Lbs. per M/H

SHIPMENTS & BILLINGS:	TOTAL	REGULAR	G. I. C.	OTHER
Shipments from Troy — Lbs. (incl. to C. S.)				
Billings (incl. ships. from Consigned Stock)				

Good Brass Production = ________ % of Iron Production.

Average Selling Price Per Lb. on Lbs. Shipped ________; on Iron Production ________

11.21

M-522-5000-1948

[illegible]
[illegible]
[illegible]

DEPT.____________

DEPT. NO.____________

[illegible]____________

[illegible]	4.	5.	6.	7.	8	9	10.	11.	12.	13.	14.	15	16	[illegible]
	DIRECT LABOR HOURS					POUNDS	UNITS	UNITS	NORMAL	O.T.	IND.	D/L	TOTAL	[illegible]
YS	TOTAL	OFF. STD.	STD. HOURS	ACT. ON STD.	% PERF	ASSEMBLED PROD.	PROD. D/L Hrs	PROD. TOT. Hr	WEEK 40 Hrs	HOURS	LABOR HOURS	COST HOUR	COST [illegible]	[illegible]
ND	WORKED													

28854
R96 Ryavec
Management engineering report on the Resselaer Valve Company.